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Unit 1: Workshop Overview
Visual 1: G0251 Workshop in Emergency Management Amateur Radio Resources

Key Points

**Workshop Overview**

- Emergency exits and procedures
- Location of restrooms
- Procedures for breaks
- Use of the "parking lot" for questions.
Visual 2: Workshop Overview

In this workshop, you will learn:

• Why your plan should include amateur radio resources
• How amateur radio groups can help during emergencies
• What amateur radio resources can do
• How to achieve a successful RACES organization
• What you can do in your community

Key Points

This workshop is about using amateur radio, or "ham" radio, as a resource for emergency communications. Ham radio operators are licensed and highly capable; they are called amateurs simply because they don't get paid for their services.

In addition to using ham radio as a hobby, many amateur radio operators eagerly volunteer their time and equipment during emergencies to provide valuable communications when other, more traditional, means of communicating fail.

Upon completion of the workshop, participants should be able to:

• Explain the importance of amateur radio for emergency communications.
• Describe the amateur radio groups that can provide emergency communications.
• Explain the capabilities of amateur radio resources.
• Explain how to achieve a successful RACES/ACS organization.
• Determine a strategy for coordinating with amateur radio resources in the community.
Visual 3: What is Amateur Radio?

A radio communication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.

Key Points

A radio communication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.

Amateur radio includes licensed amateur radio operators and stations providing amateur service. The amateur service is made up of more than 600,000 U.S. radio operators licensed by the Federal Communications Commission (FCC).

Amateur Radio Operators are often referred to as "Ham" radio operators. Ham radio operators are often able to get information that emergency responders do not have time to obtain, accurately and quickly. They provide information for the decision-making process and help to determine needed resources.
Visual 4: Introductions

- Name
- Location
- Job description
  - Primary responsibilities
  - Any experience with amateur radio
Visual 5: Why Your Plan should include Amateur Radio Resources

Why Your Plan should include Amateur Radio Resources

Key Points

**Topic 1: Why Your Plan Should Include Amateur Radio Resources**

If you're not familiar with the capabilities of amateur radio, the first question you may ask when considering the use of ham volunteers in emergency operations is "why?"

This section will give you an overview of the reasons that emergency management agencies across the country are including amateur radio resources in their disaster planning efforts.
Visual 6: Topic Overview

- Benefits of amateur radio
- Qualifications of amateur radio operators
- NIMS, the NRF, and the NECP

### Key Points

**Topic Overview**

In this part of the workshop, you will learn what amateur radio is and some basic information about how it can be used during emergencies.

When you finish this topic, you should be able to:

- Describe the benefits of amateur radio.
- Describe the different classes of Amateur licenses that may be held by amateur radio operators.
- Explain how the National Response Framework (NRF), the National Incident Management System (NIMS), and the National Emergency Communications Plan (NECP) relate to the use of amateur radio in emergencies.
Visual 7:  How will Emergency Responders Communicate when normal systems are disrupted?

Key Points

**Benefits of Amateur Radio**

During an emergency, normal communications may not be operational. For example, this communications tower is one of several that were knocked down during the 2007 winter storms in Kansas. Being able to communicate quickly and effectively is vital for emergency response personnel.

Amateur radio operators can provide:

- A dedicated team to respond in case of emergency.
- "Eyes and ears" on the ground when and where they are needed (e.g., tornado spotters).
- Additional information for the EOC, relayed from the scene (e.g., damage assessment).
- A form of communication that is virtually impervious to disasters.
- Emergency communications over different modes.
Visual 8: Benefits of Amateur Radio

- Dedicated response team
- Reliable communication in emergencies
- Access to many modes
- Interoperability
- Wider deployment
- Minimal or no equipment costs

**Key Points**

- Some degree of interoperability, because an amateur radio operator providing communications for one response agency can communicate with another amateur radio operator providing communications for another agency.
- This interoperability is enabled if the amateurs are communicating using authorized amateur radio service frequencies, since they are then authorized to use the same frequencies.
- Interoperability is one of the greatest obstacles to post-disaster communications, since local and mutual aid response agencies have radio equipment that generally lacks capability to operate on the frequencies of other responders.
- Quick response to and communications from disaster sites in their immediate areas.
- Their own equipment, usually.
Visual 9: Amateur Radio Licensing

- **Current Operator Classes**
  - Technician
  - General
  - Amateur Extra

- **Grandfathered Operator Classes**
  - Novice
  - Technician Plus
  - Advanced

Key Points

**Amateur Radio Licensing**

Amateur radio operators are qualified, capable people who have received their licenses from the FCC by passing stringent examinations that demonstrate their knowledge of communications theory and practice. The results of the exam determine the operator class of the license. Each class has different privileges associated with it.

**Current Operator Classes:**

- The Technician Class operator license is for beginners. These operators are authorized to transmit on channels in any of the frequency bands above 50 MHz with up to 1,500 watts of power. Technician Class licensees also have privileges in four amateur service bands in the HF range (3-30 MHz).
  - To obtain the Technician Class operator license, applicants must pass a 35-question written examination that covers basic regulations, operating practices, and electronics theory.

- The General Class operator license authorizes privileges in all amateur service bands with high power. The ability to operate on HF bands with high power enables these operators to communicate across the country and even around the world.
  - To qualify for a General Class operator license, the operator must pass the Technician Class written exam as well as another 35-question written examination that covers intermediate regulations, operating practices, and electronics theory.

- Amateur Extra Class operator license holders are authorized to operate on all frequencies allocated to the Amateur Service.
  - To qualify for the Amateur Extra Class operator license, applicants must pass the above two exams as well as a 50-question written examination that covers more obscure
regulations, specialized operating practices, advanced electronics theory, and radio equipment design.

**Grandfathered Classes**

The grandfathered licenses may be modified or renewed, but new amateur radio operators are not assigned to these operator classes.

- The Novice Class operator license is for persons who have passed the 5 wpm telegraphy examination, but only the first part of the written examination formerly required for the Technician Class. Privileges include four bands in the HF range, one band in the VHF range (30-300 MHz), and one band in the UHF range (300-3,000 MHz).

- The Technician Plus Class operator license was issued to Technician Class licensees, who, in addition to passing a written examination, also had passed at least a 5 wpm telegraphy examination. A Technician Plus Class licensee is authorized the privileges of a Technician Class licensee plus the privileges of a Novice Class licensee.

- The privileges of an Advanced Class operator license include 275 kHz of additional spectrum in the HF bands.
Visual 10: Case Study:

Case Study:
Columbia County, Part 1

Key Points

Case Study: Columbia County, Part 1
- What assumptions are made by emergency management personnel about amateur radio operators?

Key Points

Case Study: Columbia County, Part 1
- The emergency managers confuse amateur radio with CB radio. What are the differences?

Key Points

Case Study: Columbia County, Part 1
- If it's true that hams were reporting tornadoes that weren't there, how could that situation be prevented?
Visual 11: National Incident Management System (NIMS)

- What is NIMS?
- Why do we need NIMS?
- Who needs to know about NIMS?
- How does NIMS apply to the use of amateur radio in emergencies?

### Key Points

**NIMS, the NRF, and the NECP National Incident Management System**

- What is NIMS?
  - NIMS is a comprehensive, national approach to incident management that is applicable at all jurisdictional levels and across functional disciplines. It is intended to:
    - Be applicable across a full spectrum of potential incidents, hazards, and impacts, regardless of size, location, or complexity.
    - Improve coordination and cooperation between public and private entities in a variety of incident management activities.
    - Provide a common standard for overall incident management.

- Why do we need NIMS?
  - NIMS provides a consistent nationwide framework and approach to enable government at all levels (Federal, State, local, tribal, and territorial), the private sector, and nongovernmental organizations (NGOs), to work together to prepare for, prevent, respond to, recover from, and mitigate the effects of incidents regardless of the incident's cause, size, location, or complexity.

- Who needs to know about NIMS?
  - NIMS is applicable to State, local, tribal, and territorial governments, private sector organizations, critical infrastructure owners and operators, NGOs, and other organizations with an active role in emergency management and incident response. Elected and appointed officials, who are responsible for jurisdictional policy decisions, must also have a clear understanding of their emergency management roles.

- How does NIMS apply to amateur radio operators?
  - NIMS provides the framework to enhance the ability of responders, including the private sector and NGOs, to work together more effectively. Amateur radio operators facilitate good communication and interoperability.
Visual 12: National Response Framework (NRF)

- What is the NRF?
- Why do we need the NRF?
- How does the NRF relate to NIMS?
- How does the NRF apply to the use of amateur radio in emergencies?

**Key Points**

**The National Response Framework**

- **What is the NRF?**
  - The *National Response Framework* (NRF) is a guide that details how the Nation conducts all-hazards response, from the smallest incident to the largest catastrophe. The Framework establishes a comprehensive, national, all-hazards approach to domestic incident response.

- **Why do we need the NRF?**
  - The purpose of the NRF is to ensure that leaders of all levels of government, private-sector, and nongovernmental organization (NGO) and emergency management practitioners across the nation understand the domestic incident response roles, responsibilities, and relationships in order to respond more effectively to any type of incident.

- **Who needs to know about the NRF?**
  - The NRF is written especially for government executives, private-sector and nongovernmental organization (NGO) leaders, and emergency management practitioners.

- **How does the NRF relate to NIMS?**
  - The NIMS and the NRF are companion documents, and are designed to improve the Nation's incident management and response capabilities. While NIMS provides the template for the management of incidents regardless of size, scope, or cause, the NRF provides the structure and mechanisms for national level policy of incident response. Together, the NIMS and the NRF integrate the capabilities and resources of various governmental jurisdictions, incident management and emergency response disciplines, non-governmental organizations, and the private-sector into a cohesive, coordinated, and seamless national framework for domestic incident response.

- **How does the NRF apply to amateur radio operators?**
  - The NRF describes the process for how the private sector interfaces with other response organizations during an incident,
and better articulates the private sector's relationships with other response entities. The section titled "Emergency Support Function (ESF) #2" provides communications support to Federal, State, local, tribal, and territorial governments and first responders when their systems have been impacted during emergencies.
Visual 13: National Emergency Communications Plan (NECP)

Key Points

The National Emergency Communications Plan

- What is the NECP?
  - The NECP is a strategic plan that sets goals and identifies key national priorities to enhance governance, planning, technology, training and exercises, and disaster communications capabilities. The NECP provides recommendations, including milestones, to help emergency response providers and relevant government officials make measurable improvements in emergency communications over a three-year period, beginning with 2010.

- What are the goals of the NECP?
  - Goal 1: By 2010, 90 percent of all high-risk Urban Areas designated within the Urban Area Security Initiative (UASI) are able to demonstrate response-level emergency communications within one hour for routine events involving multiple jurisdictions and agencies.
  - Goal 2: By 2011, 75 percent of non-UASI jurisdictions are able to demonstrate response-level emergency communications within one hour for routine events involving multiple jurisdictions and agencies.
  - Goal 3: By 2013, 75 percent of all jurisdictions are able to demonstrate response-level emergency communications within three hours of a significant event as outlined in national planning scenarios.

- How does the NECP relate to NIMS and the NRF?
  - The NECP was developed to be consistent with overarching Homeland Security preparedness and response doctrine. This includes the National Incident Management System (NIMS) and the National Response Framework (NRF). The NECP establishes goals, objectives, and initiatives for interoperable and operable emergency communications that will support incident management. This includes objectives and initiatives that focus on improving governance structures and standard operating procedures to bolster response operations. In addition, the NECP
contains initiatives and milestones that seek to accelerate the implementation of emergency communications components in the NRF by public safety agencies across the Nation.

- How does the NECP apply to amateur radio operators?
- The vision of the NECP is to ensure emergency response personnel at all levels of government and across all disciplines, can communicate as needed, on demand, and as authorized, through improvements in communications operability, interoperability, and continuity nationwide. Amateur radio operators are vital to the accomplishment of this vision, by being actively involved in the emergency management activities of their communities.
Visual 14:  Topic Review

Topic Review

Key Points

**Topic Review**

Amateur radio is widely used in the United States. There are more than 600,000 operators licensed by the FCC. Amateur radio operators, working through RACES or ARES and operating under the auspices of a State or jurisdictional emergency management agency, can provide critical communications links during an emergency.

- What benefits can amateur radio operators provide for a community during emergencies?
- Which operator class allows amateur radio operators to operate on all frequencies allocated to the Amateur Service?
- How do the NRF, NIMS, and NEMC relate to the use of amateur radio operators in emergencies?
Unit 2: How Amateur Radio Groups Can Help During Emergencies
Visual 1: How Amateur Radio Groups Can Help During Emergencies

How Amateur Radio Groups Can Help During Emergencies
Visual 2: Topic Overview

- ARRL, ARES, RACES and ACS
- Relationship between RACES and emergency management agencies
- Restrictions regarding RACES communications
- Relationship between ACS and emergency management agencies

Key Points

**Topic Overview** In emergencies, communications are often the weak link in the management chain. In this part of the workshop, you will learn more about how amateur radio resources can help ensure reliable communications during emergencies.

When you finish this topic, you should be able to:

- Distinguish among the American Radio Relay League (ARRL), the Radio Amateur Civil Emergency Service (RACES), and the Amateur Radio Emergency Services (ARES) and the Auxiliary Communications Service (ACS).
- Describe the relationship between RACES and emergency management agencies.
- Summarize the restrictions regarding civil defense communications that RACES is authorized to transmit.
Visual 3: Amateur Radio Groups

- **American Radio Relay League (ARRL)**

- **Amateur Radio Emergency Service (ARES)**

---

**Key Points**

**Amateur Radio Groups**

There are many organizations to which amateur radio operators may belong. The groups listed are the three main amateur radio groups.

- **ARRL**
  - The American Radio Relay League (ARRL) is the national membership association for amateur radio operators. It can be helpful in locating local chapters and discovering the amateur radio operators in your community.

- **ARES**
  - ARES was developed by ARRL in 1935 as an organization dedicated to public-service and emergency communication. Today, this organization is made up of more than 25,000 amateurs nationwide who have voluntarily registered their services. They are organized into a well-trained network of operators capable of
providing reliable primary or secondary communications links for governmental agencies and/or nonprofit organizations when needed.

ARES is one of two established amateur radio resources that can provide emergency communications. The other is Radio Amateur Civil Emergency Service (RACES).
Visual 4: Amateur Radio Groups

- Radio Amateur Civil Emergency Service (RACES)

- Auxiliary Communications Service (ACS)

Key Points

RACES

RACES is administered by the Federal Emergency Management Agency (FEMA) of the U.S. Government. It is a part of the amateur radio service that provides radio communications support during periods of local, regional, or national emergencies. RACES operates under the supervision of the appropriate State or jurisdictional emergency management agency.

RACES organizations can be formed by State and jurisdictional emergency management agencies. Because these are primarily locally based organizations there are no firm estimates on the number of volunteers participating nationwide. In RACES, amateur radio operators are affiliated with a State or jurisdictional emergency management agency and amateur stations are registered with the agency (or the agency has a FCC-licensed RACES station). RACES is usually structured so that an individual RACES organization is managed by a State or jurisdictional emergency management director or coordinator, with assistance from a RACES Officer. The emergency management agency trains, tests, and includes RACES members in exercises.

Auxiliary Communications Services (ACS) Program provides for government use of emergency communications specialists from the other organizations. Additionally, the program provides the Emergency Management Agency (EMA) with a primary redundant emergency communications unit that also serves to set an example of how the unit can...
serve government. ACS members provide emergency communications support through a diverse group of organizations: RACES, ARES, MARS, local clubs, and the NWS SKYWARN program. Others who are not licensed Amateur Radio operators also provide emergency communications support through organizations such as REACT, the Civil Air Patrol, the US Coast Guard Auxiliary, and others.

Be sure to check for local clubs in your area that may or may not be affiliated with the groups listed above.

Another amateur radio group that participants may want to be aware of is the Military Affiliate Radio System (MARS):

Managed by the Army, Air Force, and Navy, the MARS program uses amateur radio operators primarily to help maintain communications between military personnel and their family members. MARS was once very active, but it has declined in activity with the increased availability of telephone service worldwide. For areas with a heavy Naval presence, MARS may still provide supportive resources for certain emergency situations.
Visual 5: RACES and ARES Compared

**RACES**: An official activity defined by the FCC
**ARES**: A volunteer, non-governmental activity run by ARRL members
Both used for emergency communications

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<table>
<thead>
<tr>
<th>Key Points</th>
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<tbody>
<tr>
<td><strong>RACES and ARES Compared</strong></td>
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<tr>
<td>It is important to understand that although RACES and ARES are separate entities, the amateur radio community advocates dual membership and cooperative efforts between the groups whenever possible. The RACES regulations now make it simple and possible for an ARES group whose members are all enrolled in and certified by RACES to operate in an emergency with great flexibility. Using the same operators and the same frequencies, an ARES group also enrolled as RACES can &quot;switch hats&quot; from ARES to RACES and RACES to ARES to meet the requirements of any situation as it develops.</td>
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<tr>
<td>The various amateur radio resources, in addition to their principal purpose as defined in the FCC regulations, have their distinct features, purposes, and capabilities. State and jurisdictional emergency management agencies should become knowledgeable about the various resources, understand the different kinds of communications that they can be authorized to provide, and if desired, develop plans to use these resources.</td>
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</table>
Visual 6: Relationship Between RACES and Emergency Management Agencies

- Authority and management
- Selection, testing, training, and exercising
- RACES stations within EOC
- Integration with the agency
- Registration and identification

Key Points

**Relationship Between RACES and Emergency Management Agencies**

RACES and ARES are both valuable resources to emergency management agencies. A well-managed amateur radio organization can provide communications that will improve an agency's response during an emergency, especially in the immediate hours following a disaster.

For many communities, the restrictions on RACES organizations are too limiting to use only RACES groups in emergency management. These communities usually work with both RACES and ARES groups. For the purposes of this workshop, we'll focus on the relationship between RACES and the emergency management agency.

Even for emergency management agencies with excellent existing communications, under the worst disaster conditions, when other communications have been disabled or communications traffic is too great, RACES can prove beneficial. RACES is the structure that emergency managers can use to benefit from amateur radio resources.

A RACES organization operates under the direction of its emergency management agency. Typically, the relationship between the two includes the following factors:

- The emergency management agency maintains the authority and management of the RACES organization, and any communications provided by RACES must be authorized by the agency. Selection, testing, training, and exercising of RACES volunteers are under the direct control of the emergency management agency.
- RACES members can become an integral part of a State or jurisdictional emergency management agency. This can contribute to a better understanding by RACES members of the emergency management agency's operating procedures, familiarity with personnel, and improved interaction.
- An EOC often has a RACES station and a RACES operator. RACES can provide links between EOCs that have RACES operators and stations.
• RACES members, as registrants with an emergency management agency, are normally issued agency identification cards. This facilitates access by RACES volunteers to an EOC's communications center or a restricted staging area at a disaster scene.
Visual 7: Using RACES for Emergency Communications

State-wide, regional, and national communication during:

- Natural disasters
- Technological disasters
- Civil disorder
- Nuclear/chemical incidents
- Terrorist attacks

Key Points

Using RACES for Emergency Communications

Whether operating as RACES members or ARES members, amateur radio operators are required to follow various rules and regulations regarding the types of emergency communications that they are authorized to transmit. Although ARES members are required to follow FCC regulations, they are not bound by the requirements in Title 47 CFR 97.407. These regulations are specifically for RACES.

The following are examples of emergency communications that may be provided by amateur radio resources, depending upon the resource, authorizations, and existing conditions.

- Communications for safety of life and protection of property
  - Example: In Lincoln, Nebraska, the Local Emergency Operations Plan calls for an amateur to be assigned to the admissions area of each local hospital, as well as at the triage/transport area of any disaster scene. This keeps each hospital informed of the number of patients and types of injuries to be expected, even if there is a total breakdown of the primary communications system.

- Communications for direction, control, and warning for State and jurisdictional emergency management agencies
  - Example: A disaster scene may be many miles removed from a State EOC. Normal VHF/UHF channels may not cover the distances involved. Since normal telephone service is almost always destroyed or overloaded in a disaster, high frequency, long-haul communications links may provide the only communications available until normal communications can be restored.

- Back-up and supplemental emergency communications
  - Example: Communications for police, fire, and rescue can be provided when their communications systems have been disabled.
or overwhelmed by a disaster. Almost all local communication among primary operating response forces takes place through repeaters. This includes even the latest 800 megahertz trunked systems. Any system utilizing repeaters on towers at remote locations is particularly vulnerable to a wide variety of outages. When these outages occur, hams can supplement local communications (often with temporary portable repeaters) until normal communications can be restored.

- **Emergency communications for disaster relief**
  - Example: In the immediate aftermath of disaster, people from all over the country are concerned about the safety of their friends and loved ones. When telephone links are destroyed or overloaded, hams work with the American Red Cross to forward messages from the disaster area to relatives in the outside world. Also, when Red Cross shelters are opened, hams often provide the needed communications links between them.

- **Communications in support of ongoing Government programs**
  - Example: In many communities around the country, hams are dispatched by the National Weather Service to spotters' points in the area. From high locations with good fields of view, they keep in radio contact with the National Weather Service/emergency management personnel so that if severe weather does develop, warning systems can be sounded immediately. The added minutes or even seconds of early warning time they provide has unquestionably saved many lives.
Visual 8: Authorization of RACES Communications

- Governed by Title 47 CFR 97.407
- Must be authorized by the civil defense organization
- The emergency management agency usually serves as the civil defense organization

Key Points

RACES Restrictions
Keep in mind that the term "civil defense" refers to all types of disasters (i.e., natural, manmade, and technological). Emergency management agencies frequently serve as the civil defense organization in a State or locality.

Title 47 CFR 97.407 addresses requirements for radio amateur civil emergency service. According to Title 47 CFR 97.407 (e), all communications transmitted in RACES must be specifically authorized by the civil defense organization for the area served.
Visual 9: Restrictions on RACES Communications

RACES communication must be for the following purposes:

- Public safety or national defense/security
- Safety of life and protection of property
- Essential instructions
- Training drills
Visual 10: Restrictions on Drills and Tests

- Not to exceed one hour per week (total)
- No limits on ARES drills and tests
- Dual membership in RACES and ARES is recommended

Key Points

The following information, extracted from the CFR, outlines the types of civil defense communications that RACES is authorized to transmit.

Only civil defense communications of the following types may be transmitted:

- (1) Messages concerning impending or actual conditions jeopardizing the public safety, or affecting the national defense or security during periods of local, regional, or national civil emergencies;
- (2) Messages directly concerning the immediate safety of life of individuals, the immediate protection of property, maintenance of law and order, alleviation of human suffering and need, and the combating of armed attack or sabotage;
- (3) Messages directly concerning the accumulation and dissemination of public information or instructions to the civilian population essential to the activities of the civil defense organization or other authorized governmental or relief agencies; and
- (4) Communications for RACES training drills and tests necessary to ensure the establishment and maintenance of orderly and efficient operation of the RACES as ordered by the responsible civil defense organization served. Such drills and tests may not exceed a total time of 1 hour per week. With the approval of the chief officer for emergency planning in the applicable State, Commonwealth, District or territory, however, such tests and drills may be conducted for a period not to exceed 72 hours no more than twice in any calendar year.
Visual 11: Relationship Between ACS and Emergency Management Agencies

Auxiliary Communications Service (ACS) provides the EMA with a redundant emergency communications service made up of emergency communications specialists from other organizations.
Visual 12: Auxiliary Communications Services (ACS)

RACES, ARES, MARS, local Ham clubs, NWS SKYWARN

Others who are not licensed Amateur Radio operators: REACT, the Civil Air Patrol, the US Coast Guard Auxiliary, and others.

Key Points

The ACS program is based on and includes the RACES, but broadens the scope to include the use of non-amateur radio volunteers and beyond only utilizing them during emergencies. National Priorities emphasize the need to coordinate resources regionally. The ACS Program will provide the mechanism to target the coordination of these particular disaster response organizations and their resources on a statewide basis.

The ACS is an umbrella program that includes other organizations and groups for coordination and planning purposes. Moving to an ACS model will formalize the ongoing attempts at removing the barriers that have existed, in some areas, between RACES and ARES and other amateur radio groups. Another important element in the ACS model is removing of the false concept that a volunteer communications reserve is one in which ONLY Amateur Radio Service resources and frequencies are utilized in support of government communications. While many programs will continue to rely heavily upon Amateur Radio Service resources, those programs that embrace the ACS model will find it much easier to include and incorporate other communications volunteers and resources.

These volunteers come from a variety of backgrounds including radio, information technology, telephone, microwave, satellite, medicine, law and other professional backgrounds. Personnel may or may not hold FCC licenses; yet the majority are usually Amateur Radio licensees from a variety of volunteer emergency communications units.
Visual 13: Case Study: 2

Case Study:
Columbia County, Part 2

Key Points
Case Study: Columbia County, Part 2
What challenges do the ham radio operators face when trying to get involved and offer their services during emergencies?
Visual 14: Topic Review

There are a number of organizations of volunteer amateur radio operators that operates under the direction of a State or jurisdictional emergency management agency to provide communications links in the event of a disaster or communications breakdown.

- Which amateur radio group is an official activity defined by the FCC and administered by FEMA?

- When emergency management agencies work with RACES organizations, who controls the selection, testing, training, and exercising of RACES volunteers?

- What are the five types of emergency communications that RACES members are authorized to transmit?
Unit 3: What Amateur Radio Resources Can Do
Visual 1: What Amateur Radio Resources Can Do

What Amateur Radio Resources Can Do
Visual 2:  Topic Overview 2

- Amateur radio equipment, purposes, and limitations
- Transmission capabilities
- Setting up a radio station in your EOC
- Tracking locations of radio resources
- Legal and regulatory issues

Key Points

**Topic Overview**

Next, you will learn about the capabilities of amateur radio resources. This topic will also briefly summarize legal and regulatory issues related to the use of amateur radio resources.

When you finish this topic, you should be able to:

- Describe the purposes and limitations of the equipment used by amateur radio operators.
- Describe amateur radio's capabilities to transmit voice, data, and images.
- Explain the advantages of setting up a radio station in your Emergency Operations Center (EOC).
- Explain how to track locations of radio resources, antennas, and repeaters.
- Explain legal and regulatory issues governing the use of amateur radio resources.
Visual 3: Amateur Radio Frequencies

<table>
<thead>
<tr>
<th>160 Meters</th>
<th>1.800-2.000 MHz</th>
<th>80 Meters</th>
<th>3.525-4.000 MHz</th>
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<tbody>
<tr>
<td>40 Meters</td>
<td>7.000-7.300 MHz</td>
<td>30 Meters</td>
<td>10.100-10.150 MHz</td>
</tr>
<tr>
<td>10 Meters</td>
<td>28.000-29.700 MHz</td>
<td>6 Meters</td>
<td>50.0-54.0 MHz</td>
</tr>
</tbody>
</table>

2 Meters: 144.0-148.0 MHz
70 Centimeters: 420.0-450.0 MHz
33 Centimeters: 902.0-928.0 MHz
23 Centimeters: 1240-1300 MHz

Key Points

Radio Frequencies: A radio "band" is a group of frequencies. In addition to the specific bands of the radio spectrum set aside for government, military, and commercial radio uses, there are bands set aside for amateurs. Depending on which band is used, amateur radio operators can talk across town, around the world, or out to satellites in space.

There are additional, more detailed charts in the appendices.

160 Meters

General, Advanced, Amateur Extra licensees: 1.800-2.000 MHz:
80 Meters

Novice and Technician licensees: 3.525-3.600 MHz: General class: 3.525-3.600 MHz: 3.800-4.000 MHz: Advanced class: 3.525-3.600 MHz: 3.700-4.000 MHz: Amateur Extra class: 3.500-3.600 MHz: 3.600-4.000 MHz:

60 Meters: Five Specific Channels (Not on Visual due to limited Amateur use)
The FCC has granted hams secondary access on five discrete channels. Amateurs cannot cause inference to and must accept interference from the Primary Government users. General, Advanced and Amateur Extra licensees:

**Channel Center**
- 5332 kHz
- 5348 kHz
- 5368 kHz
- 5373 kHz
- 5405 kHz (common US/UK)

**40 Meters**
Novice and Technician licensees:
- 7.025-7.125 MHz:

General class:
- 7.025-7.125 MHz:
- 7.175-7.300 MHz:

Advanced class:
- 7.025-7.125 MHz:
- 7.125-7.300 MHz:

Amateur Extra class:
- 7.000-7.125 MHz:
- 7.125-7.300 MHz:

**30 Meters**
General, Advanced, Amateur Extra licensees:
- 10.100-10.150 MHz:

**20 Meters**
General class:
- 14.025 -14.150 MHz
- 14.225 -14.350 MHz:

Advanced class:
- 14.025 -14.150 MHz
- 14.175 -14.350 MHz:

Amateur Extra class:
- 14.000 - 14.150 MHz
- 14.150 -14.350 MHz:

**17 Meters**
General, Advanced, Amateur Extra licensees:
- 18.068-18.110 MHz:
<table>
<thead>
<tr>
<th><strong>15 Meters</strong></th>
<th>Novice and Technician licensees:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 21.025-21.200 MHz:</td>
<td>General class:</td>
</tr>
<tr>
<td>• 21.025-21.200 MHz:</td>
<td>• 21.275-21.450 MHz:</td>
</tr>
<tr>
<td>• 21.025-21.200 MHz:</td>
<td>Advanced class:</td>
</tr>
<tr>
<td>• 21.000-21.200 MHz:</td>
<td>Amateur Extra class:</td>
</tr>
<tr>
<td>• 21.200-21.450 MHz:</td>
<td></td>
</tr>
<tr>
<td><strong>12 Meters</strong></td>
<td>General, Advanced, Amateur Extra licensees:</td>
</tr>
<tr>
<td>• 24.890-24.930 MHz:</td>
<td>• 24.930-24.990 MHz:</td>
</tr>
<tr>
<td><strong>10 Meters</strong></td>
<td>Novice and Technician licensees:</td>
</tr>
<tr>
<td>• 28.000-28.300 MHz:</td>
<td>General, Advanced, Amateur Extra licensees:</td>
</tr>
<tr>
<td>• 28.300-28.500 MHz:</td>
<td>• 28.000-28.300 MHz:</td>
</tr>
<tr>
<td>• 28.300-29.700 MHz:</td>
<td>• 28.300-29.700 MHz:</td>
</tr>
<tr>
<td><strong>6 Meters</strong></td>
<td>All Amateurs except Novices: 50.0-50.1 MHz: 50.1-54.0 MHz:</td>
</tr>
<tr>
<td><strong>2 Meters</strong></td>
<td>All Amateurs except Novices: 144.0-144.1 MHz: 144.1-148.0 MHz:</td>
</tr>
<tr>
<td><strong>1.25 Meters</strong> (Not on Visual due to limited Amateur use)</td>
<td>The FCC has allocated 219-220 MHz to amateur use on a secondary basis. Novice, Technician, General, Advanced, Amateur Extra classes: 222.00-225.00 MHz:</td>
</tr>
<tr>
<td><strong>70 Centimeters</strong></td>
<td>All Amateurs except Novices: 420.0-450.0 MHz:</td>
</tr>
</tbody>
</table>
| **33 Centimeters** | All Amateurs except Novices: 902.0-928.0 MHz:
23 Centimeters
Novice class: 1270-1295 MHz:
All Amateurs except Novices: 1240-1300 MHz:
Visual 4: Amateur Radio Equipment

- Radios - Amateur, GMRS and FRS
- Antennas
- Repeaters
- Emergency power supplies
- Phone patches
- Satellite communications equipment
- Communications vans

Key Points

**Amateur Radio Equipment** Amateur radio operators and amateur radio clubs have their own equipment, which may include:

- Radios - Amateur, GMRS and FRS
- Antennas
- Repeaters
- Emergency power supplies
- Phone patches
- Satellite communications equipment
- Communications vans.
Visual 5:  Amateur Radios

Key Points

**Radios**
Radios may be used to transmit and receive voice and data. They may be handhelds, portables, base stations, or mobiles.

An amateur radio station can be situated in an emergency operating center (EOC), or an amateur radio operator can transport radio communications equipment to the command post at the scene of a disaster and provide communications back to an EOC.
Visual 6: ACS Radios

GMRS Radios - CB Radios - FRS Radios

Key Points

The General Mobile Radio Service (GMRS) is a mobile FM UHF radio service designed for short-distance two-way communication. It requires a license, the license is valid for an adult as well as his or her immediate family members.

The Family Radio Service (FRS) is an improved walkie talkie radio system authorized in the United States since 1996. This personal radio service uses channelized frequencies around 462 and 467 MHz in the ultra-high frequency (UHF) band, also used by cordless phones, toys, and baby monitors.

Citizens' Band radio (CB radio) is a system of short-distance radio communications between individuals on a selection of 40 channels within the 27-MHz (11 m) band.
Visual 7: Antennas

Key Points

**Antennas**

Critical to the operation of amateur radio equipment is the capability to send and receive radio signal. For this purpose, antennas are required. The antenna is the part of a radio system that radiates or receives the radio signal. Although amateur radio operators will generally supply radios and other equipment, antennas may need to be supplied by the emergency management agency.

Very simple antennas can be set up quickly wherever they are required. The photo on the slide shows an antenna held upright by a ladder. They can also be positioned in a bucket with rocks surrounding the pole.

To make the most effective use of amateur radio in emergencies, the emergency management agency should also install permanent fixed antennas (e.g., atop the EOC, a water tower, etc.).

Hams use many different kinds of antennas, but the most common are wire, verticals, or beams.

- Wire antennas are most often used in the HF bands. They are simply a length of wire attached to the transceiver. They must usually be of a certain length so they will perform well at a particular frequency.
- Vertical antennas can be designed for a single band or for many bands. They can be used in mobile situations as well as fixed stations.
Vertical antennas are characterized by the fact that they radiate and receive radio signals omnidirectional, that is, equally in all directions.

- Beam antennas have the advantage of being directional; they can be pointed in any direction so that, for transmission, more of the signal can be directed where desired. For reception, stations can be heard from a particular area better than with an omnidirectional antenna.
Visual 8:  Repeaters

Key Points

Repeater

Repeaters are ham radio relay stations. Repeater antennas are typically placed on the tops of mountains or very tall buildings so that the line-of-sight distance they cover is quite large. Repeaters allow hams using low-power, mobile, or hand-held radios to transmit and receive from stations 50 or even 75 miles away.

Amateur radio operators usually supply their own repeaters; often, the repeaters consist of equipment that has been modified for use on ham frequencies. If the emergency management agency does need to provide the equipment, however, it is generally not very expensive.

State and jurisdictional emergency management agencies may have a repeater network that allows amateur radio transmissions. (Often, in an emergency, a State or locality will let only RACES stay on the network, allowing it to preempt ARES and other amateur radio transmissions.)
Visual 9: Other Equipment

Satellite Communications - Emergency Power Supplies - Communications Vans

Key Points

Other Equipment

- Satellite Communications Equipment
- Emergency power supplies
  - Batteries
  - Generators
- Communications vans and mobile command posts
- Phone patches for interconnecting radio equipment to local telephone lines for communicating between two points where long-haul telephone circuits may be damaged or overloaded

Keep in mind that emergency managers can coordinate with home stations as well, so some of the equipment may not be in the EOC. The particular equipment installed in the EOC may vary depending on how the RACES officer and local clubs work.
Visual 10: Capabilities

- Voice
- Morse Code
- Digital
  - Teletype
  - Television
  - FAX
  - Email

Key Points

**Capabilities**

Amateur radio operators have the ability to transmit voice, data, and images.

- Voice communication is the mode we are all familiar with. Generally, when we think of ham radio operators, we think of people communicating vocally using a microphone.
- Morse code, Referred to by hams as "cw" (for continuous wave), this is the mode used by the early radio pioneers. While slower than most modes (a faster operator can send and receive upward of 20 words per minute), Morse code will get through in poor transmission conditions when nothing else will.
Visual 11: Digital Capabilities

- Multiple digital modes are available
- Send and Receive ICS Forms, text documents, spreadsheets, ARRL Radiogram, Red Cross and Hospital forms
- Files can be sent easily and with 100% verification

Key Points

The widespread use of PCs and Digital Signal Processing (DSP) is allowing radio amateurs to use these tools to develop new modes of digital communication. The distinguishing features of live digital operation today are the use of lower power, and compact or indoor antennas. A number of the software programs needed for digital communications are Freeware. Some of the more common digital modes are listed.

- Packet Radio is thirty year old technology, however many parts of the country still use Packet as their primary means of sending data traffic. Packet Radio is not a good method of sending data files such as pictures and spreadsheets. Packet is a particular digital mode of Amateur Radio communications which corresponds to computer telecommunications. The modem is replaced by a terminal node controller (TNC); the telephone is replaced by an amateur radio transceiver, and the phone system is replaced by the amateur radio waves. Packet radio takes any data stream sent from a computer and sends that via radio to another amateur radio station similarly equipped. Packet radio is so named because it sends the data in small bursts, or packets.

- Packet has three great advantages over other digital modes: transparency, error correction, and automatic control. Another advantage of packet over other modes is the ability for many users to be able to use the same frequency channel simultaneously.

- The operation of a packet station is transparent to the end user; connect to the other station, type in your message, and it is sent automatically. The terminal Node Controller (TNC) automatically divides the message into packets, keys the transmitter, and then sends the packets. While receiving packets, the TNC automatically decodes, checks for errors, and displays the received messages. Packet radio provides error free communications because of built-in error detection schemes.

- Narrow Band Emergency Messaging System (NBEMS)

- NBEMS is rather new suite of programs that is rapidly gaining support and use across the country. NBEMS has the ability to send message forms, pictures and spreadsheets in an acceptable time span.

- The Narrow Band Emergency Messaging System (NBEMS) is a suite of software programs designed for fast, error-free, long-distance
emergency messaging. NBEMS is an Open Source software suite that allows amateur radio operators to reliably send and receive data using nearly any computer (Windows, Mac, and Linux) and any analog radio. NBEMS software provides a digital radio sound card modem and a form-based messaging program in two separate applications that work together to form a perfect software suite for emergency radio digital communications. The software is free and multi-platform (Windows / Linux / Mac).

- NBEMS works on both VHF/UHF FM and on HF. FLDIGI handles a wide range of Amateur Radio digital modes. It is a computer program intended for Amateur Radio Digital Modes operation using a PC and operates in conjunction with a conventional HF SSB & VHF/UHF FM transceiver connected to the input and output sockets of the PC sound card. A serial port connection is used for rig control. FLDIGI is multi-mode, which means that it is able to operate many popular digital modes without switching programs, so you only have one program to learn. It includes all the popular modes, such as DominoEX, MFSK16, PSK31, and RTTY.

- In the average RACES or ARES event, it is likely used to supplement voice communications, not replace them. Digital modes are likely used when an ARES/RACES station has already established voice communication with a desired target station (e.g. an EOC or shelter). During the event an agency may request that RACES/ARES send information that is very detailed, and accuracy is very important. Via voice, to ensure accuracy, NTS-style radiograms could be used effectively but the dictation speed needed for accuracy will slow things down quite a bit. If voice is the only means available, it will still work well, but the ability to use error correcting or error checking digital modes will greatly assist the operations. However, ICS forms such as ICS-259 are very detailed and sending via voice is nearly impossible. So, in a real situation, the ham station may be having brief voice communication with an EOC or shelter and then decide to send a ICS-213, ICS-259 or Red Cross 5266 form via a digital mode. Demonstrations of the newer higher speed PSK modes have shown that large files (260KB) can be send via NBEMS in as little as three to five minutes.

- Amateur Television (ATV)
  - ATV is a fast-growing mode which permits nearly broadcast-quality moving pictures to be transmitted with low-power equipment within the budget of many hams and emergency management organizations. It has proven useful in transmitting real-time aerial photographs of a disaster area and in scanning the horizon from a fixed high point for tornado detection.
  - ATV is also called HAM TV or Fast Scan TV (FSTV).
  - Slow Scan Television (SSTV)
• SSTV is the transmission of still pictures over radio. This mode is very bandwidth efficient, requires minimal equipment, and is good for transmission of maps, graphics, and pictures for damage assessment. SSTV is similar to a photographic slide show on the air.
Visual 12: Case Study:

Case Study:
Columbia County, Part 3

Key Points

• What can you do to convince others in your community that amateur radio operators should be included in emergency planning and response efforts?
• What are the advantages and disadvantages of establishing an amateur radio station in the EOC?
Visual 13: Setting up a Radio Station in Your EOC

Key Points

Setting up a Radio Station in Your EOC

These pictures show how Pulaski County, Arkansas, has set up an amateur radio station in the corner of the EOC. This arrangement allows the radio operator to see and hear everything that is happening and enables him or her to participate in briefings and discussions. A headset can be used to control the noise level from radio communications in the EOC.

If needed, the radio operator can hand the microphone to someone else in the EOC and let that person speak directly to a counterpart in the field. According to Title 47 CFR Part 97.115, during third-party communications, the amateur radio operator must be present and continuously monitoring and supervising the third party's participation. In some EOCs, the ham operator is in a room off to the side or down the hall, removed from the EOC activity. Verbal or written messages are passed back and forth via runner. This arrangement may work when there are only a few formal, written messages to the state EOC, but is not recommended if amateur radio is needed to replace or supplement the tactical communication systems used every day by public safety agencies. Local amateur radio operators can help you set up a radio station in your EOC and should be involved in the process.

To locate hams in your area, search: http://www.arrl.org/find-a-club
Visual 14: Tracking Locations of Amateur Radio Resources

Key Points

Tracking Locations of Amateur Radio Resources

Geographic Information System (GIS) is a database system that can analyze and display data using digitized maps and tables for planning and decision making. Many EOCs use GIS tracking to mark locations of interest during an emergency, such as impact zones or shelters. You can also use these systems to track locations of amateur radio resources such as antennas.

Communities can use Google Earth to track locations of interest (with Google Earth Pro, they can import GIS data).

Other software includes MapWindow (free GIS program) and the Shape2Earth plug-in for MapWindow.

Many amateur radio operators have GPS units, and can provide latitude and longitude of their location, which is helpful for tracking storm spotters or reporting damage in the field.

Online resources for tracking locations of interest are listed in Appendix C.
Visual 15: Legal and Regulatory Issues

- Monetary compensation
- Worker's compensation
- FCC regulations
- State and local laws
- HIPAA Privacy Rule
- Memorandum of Understanding (MOU)
- Volunteer Protection Act of 1997

Key Points

Legal and Regulatory Issues

- Monetary compensation
  - Amateur radio operators (including RACES members) are not allowed by law to receive monetary compensation for their services.

- Worker's Compensation
  - An emergency management agency may be able to cover RACES members under their worker's compensation insurance since these volunteers are enrolled in the agency. Worker's compensation regulations may vary, so emergency management officials should check their state or jurisdictional requirements.

- FCC regulations for the amateur radio service
  - These regulations are in 47 CFR Part 97 and cover many items, including licensing of operators and licensing of stations, emissions, types of transmissions that can be made, the frequencies that can be used, and required authorizations.

- State and local laws
  - State Statutes or local codes may exist regarding volunteers to State and local government in providing volunteer emergency and disaster relief Service. An emergency management agency planning to use amateur radio resources should check into these laws.

- HIPAA Privacy Rule
  - The Health Insurance Portability and Accountability Act (HIPAA) helps guarantee patient confidentiality. As a general rule, personally identifiable information should not be transmitted. However, there are certain circumstances during an emergency in which amateur radio operators may legally transmit patient information at the request of medical professionals.
- Memorandum of Understanding (MOU)
  - A Memorandum of Understanding (MOU), mutual aid agreement, and other type of agreement should be drawn up to allow for sharing of RACES volunteers with other States or jurisdictions. An MOU can also be used to allow RACES to have priority on specific networks. It can enable RACES to use and preempt an amateur radio club's repeater network system in an emergency (as permitted by FCC regulations).

- Volunteer Protection Act of 1997
  - This Act provides liability protection for volunteers. The purpose of the Act is to "promote the interests of social service program beneficiaries and taxpayers and to sustain the availability of programs, nonprofit organizations, and governmental entities that depend on volunteer contributions by reforming the laws to provide certain protections from liability abuses related to volunteers serving nonprofit organizations and governmental entities."
Amateur radio operators provide their own equipment, including radios, antennas, repeaters, phone patches, and communications vans. In addition, they may have the ability to transmit voice, data, and images through a variety of means, allowing emergency managers and other response organizations to communicate with one another whether or not they have compatible communications systems. Amateur radio operators must comply with FCC regulations as noted in 47 CFR Part 97, and with State and jurisdiction laws where applicable. Establishing a viable RACES program requires the emergency management officials to be aware of the applicable regulations and adhere to them strictly.

- **What piece of equipment is typically placed on the top of a mountain or a very tall building to allow hams to transmit and receive from stations 50 or even 75 miles away using low-power, mobile, or hand-held radios?**

- **Besides voice transmissions, what are some of the capabilities of amateur radio?**

- **Why might it be a good idea to set up an amateur radio station in your EOC?**
Key Points

- **How can your community keep track of amateur radio resources?**

Key Points

- **What type of agreement can allow RACES to use and preempt an amateur radio club's repeater network system in an emergency (as permitted by FCC regulations)?**
Unit 4: How to Achieve a Successful Amateur Radio Organization
Visual 1: How to Achieve a Successful Amateur Radio Organization

How to Achieve a Successful Amateur Radio Organization

<table>
<thead>
<tr>
<th>Key Points</th>
</tr>
</thead>
</table>
| Note: The following Web site contains a long list of **amateur radio emergency communications organizations** in the United States:  
[http://www.qsl.net/races/links.html](http://www.qsl.net/races/links.html) |
Visual 2: Topic Overview

- Common organizational needs
- Structure of RACES/ACS organizations
- Guidelines for plans
- Developing and maintaining a working relationship with amateur radio organization members
- Keeping radio volunteers active, motivated, and trained

Key Points

**Topic Overview**

Next, you will learn how to successfully incorporate amateur radio resources into emergency operations and achieve a successful Radio Amateur Civil Emergency Service (RACES) organization.

When you finish this topic, you should be able to:

- List the four common organizational needs of emergency management agencies and RACES/ACS.
- Describe the variables that determine how RACES/ACS organizations are structured.
- Describe basic guidelines for developing a RACES/ACS plan.
- Explain how to develop and maintain an effective working relationship with amateur radio organization members.
- Identify ways to keep amateur radio volunteers active, motivated, and trained.
Visual 3: Common Organizational Needs

Key Points

Organizational Needs

Each mission area of emergency management (mitigation, protection, prevention, response, and recovery) requires the same things—people, plans, equipment, and facilities. To effectively integrate amateur radio into emergency management capabilities, the same four factors need to be addressed.

Both the emergency management agency and RACES/ACS have these common organizational needs.

- **People**
  - Emergency management needs to identify, train, exercise, and manage its people.
  - RACES people are the hams who need to be identified, trained, exercised, and managed as part of the emergency management agency.

- **Plans**
  - Emergency management needs plans to be developed, tested, refined, and disseminated to people who will implement them.
  - RACES needs plans to be developed, tested, refined, and disseminated to people who will implement them.
• Equipment
  • Emergency management needs equipment to be identified, acquired, deployed, tested, and maintained.
  • RACES needs equipment to be identified, acquired, deployed, tested, and maintained.

• Facilities
  • Emergency management needs facilities to be available and suitable to the function.
  • RACES need facilities to be available and suitable to allow the integration of RACES volunteers and emergency management.
Visual 4:  Who's missing a place at the table?

<table>
<thead>
<tr>
<th>Chief Executive Officer</th>
<th>School Official</th>
<th>Resource Officer</th>
<th>Public Works</th>
<th>Emergency Manager</th>
</tr>
</thead>
</table>

Key Points

**The RACES/ACS Officer**

When establishing a RACES/ACS organization, the director of the State or jurisdictional emergency management agency (or designee) should appoint in writing a reliable RACES/ACS officer to act as liaison between the radio organization and the emergency management agency.
Visual 5: The RACES/ACS Officer

Key Points
The RACES/ACS Officer should be a General Class license holder (or higher) who is thoroughly knowledgeable of FCC rules and regulations, and who is familiar with the functions of the ARRL and ARES.
Visual 6: The RACES/ACS Officer

- Assists with RACES/ACS plan development
- Assists in development and expansion
- Recruits members
- Assists with training development
- Assists with exercises and drills

Key Points

The RACES/ACS officer's duties may consist of

- Assisting the agency with radio plan development.
- Assisting in development and expansion of the organization.
- Recruiting members.
- Assisting the emergency management agency in developing training programs for RACES/ACS members.
- Assisting the emergency management agency in developing RACES/ACS exercises and drills to maintain communications capabilities.
Visual 7: RACES/ACS Plan Components

- Area of responsibility
- Types of communications
- Authorized frequencies and modes
- Emergency management agency contacts
- Activation conditions
- FCC rules and regulations

Key Points

Guidelines for RACES/ACS Plan Development

A critical element in working successfully is a well-written RACES/ACS plan. State and localities may have variations in their plans, and many communities combine the RACES plan with an ARES, ACS or other organization plan.

Some create a stand-alone document, and others have their plan as an annex to their emergency operations plans. Some States and localities simply include planning for radio operations as an appendix or in a section of their communications or emergency response plans.

Your community will need to determine whether to create a separate plan or combine the radio plan with another emergency communications plan, and whether the plan should stand alone or be included as an annex in an emergency operations plan. However you choose to develop the plan, it must be created as a cooperative effort among amateur radio operators, emergency management officials, and other agencies to correlate with other emergency planning efforts.

The following are some key factors that must be incorporated into an Amateur Radio Emergency Communications Plan.

The plan should:

- Identify the community or area of the RACES/ACS organization's responsibility.
- Identify the general types of communications support the RACES/ACS organization is intended to provide.
- Identify the authorized RACES frequencies and modes to be utilized during RACES operations.
- Identify the individual or individuals in the emergency management agency to whom the RACES organization reports. Include a blanket statement that makes clear that "FCC rules and regulations apply to the operation of a radio in the amateur service and therefore apply to the RACES organization."
- Define under what conditions the RACES/ACS organization will be activated. In accordance with the State or jurisdictional emergency
operations plan, the appropriate representative of the emergency management agency may activate the organization to provide communications support for one or more of the following needs:

- Preservation of life or property.
- Alleviation of human suffering or need.
- Any disaster endangering the public.
- Tests and drills.
- Other reasons he/she may deem necessary.
Visual 8: Variations in RACES/ACS Structure

- Area of responsibility
- Types of communications
- Authorized frequencies and modes
- Emergency management agency contacts
- Activation conditions
- FCC rules and regulations

Key Points

Variations in RACES/ACS Structure

There are variations among States and localities in the way they structure and organize RACES/ACS. A State or locality may have specific guidelines on establishing a RACES/ACS organization, how it defines the use of RACES/ACS, and how it is organized in order to meet the specific needs of their particular situation.

- Some States and localities have a blanket statement that makes ARES members part of a RACES organization (as long as individual amateur radio operators register and are accepted and enrolled by the emergency management agency).
- Such a statement might be in a Memorandum of Understanding (MOU) between the State (or locality) and an ARES group, or in a RACES/ACS plan. In other jurisdictions, instead of issuing a blanket ARES/RACES statement, the emergency management director or coordinator may carefully recruit, select, and screen the people who will become part of the agency's RACES/ACS organization. State RACES/ACS organization enrollment versus local organization enrollment.
- A State emergency management agency may require that RACES/ACS volunteers in a State organization be enrolled only in the State RACES/ACS organization and not in a local organization.
- Some localities require members to live in their locality.
- Some State and jurisdictional emergency management agencies may have minimum age requirements for members.
- Some States and localities have designed tests (and probation periods) that applicants must pass prior to being made part of RACES/ACS.
- States and localities may have their own specially designed application for potential RACES/ACS members.
- Some States may require potential members to register as volunteers with the State.
- A State may have RACES/ACS structured according to regions within the State using regional RACES/ACS officers.
• Some State emergency management agencies have localities send in their plans and current rosters of members. You will need to evaluate your own organizational needs, along with those of the amateur radio groups, to determine how best to establish, organize, and use RACES/ACS. Contact the communication officer within your State emergency management agency for information about other organizations in your area and to inquire about the possibility of partial funding that may available from FEMA for equipment and training.
Visual 9: Case Study:

Case Study:
Columbia County, Part 4

Key Points

Case Study: Columbia County, Part 4
A sample RACES plan developed for the case study is included in Appendix D.
An example manual for Arlington County, Virginia, located at the following website: http://www.w4ava.org/races/auxcomm01.htm

Key Points

- What are some components of the sample RACES plan that you particularly like?
- Consider the needs of your community. What would you need to include in a RACES plan to accommodate those needs?

The plan must be written as a cooperative effort among amateur radio operators, emergency management officials, and other agencies.
Visual 10: Suggestions for RACES/ACS Plans

- Call-up roster
- Maps
- Contact information
- Activation procedures
- Organizational chart
- Agreements
- References
- Training and exercising

Key Points
Listed are examples of components that should be included in an Amateur Radio Emergency Communications Plan.

- Include a call-up roster of current members with call signs and other data as an appendix to the plan so that it can be updated periodically rather than needing frequent plan updates.
- Include maps showing locations of EOCs, repeater sites, links between EOCs provided by RACES/ACS, links between adjacent jurisdictions and adjacent States provided by RACES, and other important sites and information.
- Include information on how to contact RACES/ACS officers.
- Include an explanation of when RACES/ACS can be activated and who is authorized to do it (at least two people). In addition to activation procedures where a jurisdictional emergency management officer or coordinator activates members, include activation procedures where the State would like a jurisdictional emergency management agency to activate its RACES/ACS (if State and jurisdictional RACES structure allows for this).
- Include an organizational chart of the RACES/ACS structure in your State or locality.
- Include in an appendix: Mutual Aid Agreements, Memorandums of Understanding, and similar documents that relate to RACES/ACS.
- Include citations to important documents that reference appropriate plans (e.g., State emergency operations plan, a local disaster response plan, a communications plan).
- Identify training needs (e.g., who will conduct the training, and when and where it will take place), as well as opportunities for exercises to keep volunteers active in community events.
### Visual 11: Other Documentation for RACES/ACS

- References to RACES/ACS plans in emergency operations plans
- SOPs for RACES/ACS
- RACES/ACS handbooks, newsletters, and bylaws
- Documentation on testing and exercising

### Key Points

**Other Documentation for RACES**

In addition to RACES plans, other documentation often exists on RACES. This documentation includes:

- References to radio plans in emergency operations plans.
- Standard Operating Procedures (SOPs) for RACES/ACS, including activation procedures.
- RACES handbooks.
- Documents or forms showing message handling and format to be used by RACES/ACS.
- Newsletters.
- RACES/ACS organization bylaws.
- Training materials.
- Documentation on testing.
- Documentation on exercising the radio team.
Visual 12: Keys to Maintaining a Working Relationship

- Understand the roles of all involved
- Treat amateur radio operators with respect
- Remember that RACES/ACS members are certified as affiliated with the agency
- Understand the scope and limits of how volunteers can be used

Key Points

**Keys to Maintaining a Working Relationship with Amateur Radio Organization Members**

It is important that State and jurisdictional emergency management officials develop and maintain an effective, working relationship with their RACES/ACS and ARES organizations.

- In order to achieve this, all parties should understand the roles of the individuals and organizations involved:
  - The emergency management director or coordinator.
  - The emergency management agency's communications officer.
  - The RACES/ACS officer.
  - The RACES/ACS/ARES volunteers.
- Emergency management officials should treat amateur radio volunteers with the respect that they show their regular emergency management agency staff.
- Remember that RACES/ACS members are certified as affiliated with the emergency management agency.
- At the same time, emergency management officials should keep in mind that the amateur radio operators are volunteering their time and energies and should understand the exact scope and limits of how they can use these qualified volunteers.
Visual 13: Brainstorming Activity

How can emergency management agencies help keep volunteers active, motivated, and trained?

Key Points
With your group, brainstorm ways that emergency management agencies can help ensure that amateur radio volunteers remain active, motivated, and trained.
Visual 14: Topic Review

Topic Review

Key Points

Topic Review

Although there are variations in the way different States and localities structure their RACES/ACS programs, any establishment of an organization must include development of a detailed plan that covers the relationships and roles of all parties involved. Building on the plan includes developing and maintaining effective working relationships and investigating funding options for radio activities.

Key Points

- What four organizational needs do RACES/ACS and emergency management agencies have in common?

Key Points

- What variations in State and jurisdictional requirements should you consider when establishing a RACES/ACS organization?

Key Points

- Why do you need a plan? What should the plan include?

Key Points

- What are some ways you can develop and maintain a good working relationship with amateur radio organization members?
Unit 5: What You Can Do in Your Community
Visual 1: What You Can Do in Your Community

What You Can Do in Your Community
Visual 2: Topic Overview

Now you will apply what you've learned by determining a strategy for coordinating with amateur radio resources in your community.

Key Points

**Topic Overview**

Now, you will apply what you've learned by determining a strategy for coordinating with amateur radio resources in your community.
Visual 3: Case Study: 5

Case Study:
Columbia County, Part 5
Visual 4: Action Item List

What can you do to get amateur radio involved in your community's emergency management operations?

**Key Points**

**Action Item List** Working on your own, create a list of action items for coordinating with amateur radio resources in your community. The action items you list should be within your realm of responsibility and capability.
Visual 5: Suggested Activities

- Conduct surveys and web searches to find amateur radio clubs
- Offer to present information at a local club meeting
- Contact your local ARRL official
- Contact your State Emergency Management Office
- Develop training and exercising programs

<table>
<thead>
<tr>
<th>Key Points</th>
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<tbody>
<tr>
<td><strong>Suggested Activities</strong></td>
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<tr>
<td>Suggested action items:</td>
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<tr>
<td>- Conduct a web search to find amateur radio clubs and seek out representatives of your local club.</td>
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<tr>
<td>- Volunteer to present a program on emergency management and the need for amateur radio support at a future club meeting.</td>
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<tr>
<td>- Contact your local ARRL official.</td>
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<tr>
<td>- Contact your State or jurisdictional emergency management office.</td>
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<tr>
<td>- If you already have a RACES, ACS or ARES organization in place, work closely with the organization in developing a meaningful training and exercising program for the organization.</td>
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A list of local clubs and contact information for local ARRL officials can be found at www.arrl.org.
Visual 6: Workshop Summary

Workshop Summary

Key Points

**Workshop Summary**

In this workshop, you've learned about the benefits of involving amateur radio resources in your emergency management operations. You should now be equipped to find amateur radio groups in your area or help form new ones if needed, and to coordinate with RACES organizations. The list of action items you created will help you take advantage of the resources that amateur radio can provide in emergencies.
Appendix A: Case Studies
Case Study – Part 1

Some of the members of two local amateur radio clubs in Columbia County have been talking about putting their “toys” to good use for the benefit of the community. A few of them talked with friends, who are Sheriff’s deputies, about volunteering their time to help with communications during emergency situations and community events. They were told that emergency management officials would handle communications in-house with trained professionals, particularly during a serious event.

At an emergency planning meeting, one of the Sheriff’s deputies mentioned that the hams and “CBers” wanted to get involved. The Director of Emergency Management told the group that a friend from the Midwest had said they had tried to use hams in a weather monitoring program there, but “the hams were reporting tornadoes that weren’t there.” Someone else said, “Volunteers don’t ever get their programs off the ground.” The idea was quickly dismissed, and the group proceeded to the next topic.

Discouraged but not defeated, the amateur radio operators talked with the administrator of the local hospital. While the administrator offered them an opportunity to participate at the annual fundraiser, he discouraged them from expecting to play a major role in real events. “After all,” he said, “real lives are at stake here.” The hams got similar responses from the Fire Department, Police Chief, and others.

Though disappointed by the less-than-enthusiastic responses, the club members decided to participate in the hospital’s fundraiser, a 5k “fun run.” The hams saw it as a way to start proving their worth to the community. They offered to go with the response teams that would be driving the route during the race so they could relay information back to the command post in the event of a medical emergency. Instead, they were directed to set up a station and broadcast results of the race while asking for pledges. Months went by with no additional opportunities for community involvement, and the membership numbers of both clubs dwindled.

<table>
<thead>
<tr>
<th>Discussion Question</th>
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<tr>
<td>• What assumptions are made by emergency management personnel about amateur radio operators?</td>
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<tr>
<td>• The emergency managers confuse amateur radio with CB radio. What are the differences?</td>
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<tr>
<td>• If it’s true that hams were reporting tornadoes that weren’t there, how could that situation be prevented?</td>
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</table>
Case Study – Part 2

Some of the hams contacted the State RACES officer but learned that the State’s involvement in the RACES program consisted merely of a roster of names and stale addresses. There were neither programs nor exercises. The RACES officer was friendly and sounded supportive, but he lacked the funding, time, and resources to follow through with any meaningful help.

Over the next several months, the clubs’ numbers continued to decline, and the remaining members felt defeated and deflated. It seemed no one wanted their help. Then one day, a new member named Dave Marley asked to call a special joint club meeting to address both groups. Dave had recently moved to Columbia County. Before that, he had been actively involved in an amateur radio group in his hometown. Full of enthusiasm and knowing that hams could do an effective job, he presented a talk on what hams had done in his hometown. His group had provided communications for many community events and for the local authorities during a variety of emergencies. Dave’s enthusiasm was infectious, and he soon had a group of more than a dozen others who decided to hold regular meetings and learn what they could about the skills they would need in order to provide effective service.

When they contacted the Director of Emergency Management for help in planning their training, she told them not to waste their time. Encouraged by Dave’s confidence, they refused to give up, and they based their training program on what Dave had done in his hometown. They also formed an ARES group, so they would be registered for communications duty if a disaster strikes.

Eventually, their offer to help with the County’s Pioneer Days parade was accepted. They did a good job and successfully summoned help for a heart attack victim by using a repeater and autopatch equipment that they had built and installed on a nearby mountain. As the months went by, they did more public service events and became more proficient. The ARES group’s membership swelled as they became more active, and the local newspaper even ran a short series of articles on the group, including an interview with Dave Marley.

Discussion Question

- What challenges do the ham radio operators face when trying to get involved and offer their services during emergencies?
- How are those challenges overcome?
- Besides technical training, what kinds of training do amateur radio operators need to effectively assist with community events and emergencies?
Case Study – Part 3

Although the ARES group in Columbia County was becoming more and more active and participated in many community events, for several years they were still not included in the planning efforts of the county’s Emergency Management Agency. Then, an event happened that caused the community leaders to see the true value of amateur radio operators during emergencies.

A private plane carrying a well-known doctor and his entire family crashed in a rugged, remote, heavily wooded canyon area. A winter snowstorm closed in, and the search effort was initially hampered by extremely poor communications between the many agencies responding. Dave Marley, who was now the club president, called the Director of Emergency Management and offered the help of his volunteers, but she said that the situation needed to be handled by “professionals.”

Several hours later, a highly respected Congressman who happened to be the father-in-law of the missing doctor, visited some of the responding agencies. The agencies reported that the search was being complicated by a lack of effective communications. After a long, uncomfortable conversation with the Congressman, the Director of Emergency Management called Dave Marley.

Within two hours, hams were stationed with the Sheriff’s Jeep Patrol commander, the Civil Air Patrol mission coordinator, the National Forest Service supervisor, and with many of the ground teams. By evening, communications were being relayed quite effectively from the search scene in the deep canyons to the Command Post in town. The next day, the five victims were found. Unfortunately, they were all dead. It was later determined that the family had survived the crash but had frozen to death in the storm. Community leaders agreed that the victims would have had a much better chance of survival if the responding agencies had been able to communicate effectively with each other from the beginning of the search.

After this event, the Director of Emergency Management became a firm believer in the amateur radio volunteers. Recognizing the potential value of hams as a communications resource, but well aware of the critical need for effective training and organization, she met with Dave Marley to discuss the problems she had observed during the event. During this meeting, she agreed to include the group in future training. As the volunteers became more proficient and organized, they were included in more and more events, as well as planning efforts. At the request of the Director, Dave Marley set up an amateur radio station in the community’s Emergency Operations Center. The amateur radio volunteers became a valued and vital part of the agency.

Discussion Question

- What can you do to convince others in your community that amateur radio operators should be included in emergency planning and response efforts?
- What are the advantages and disadvantages of establishing an amateur radio station in the EOC?
Case Study – Part 4

With the sponsorship of the Columbia County Emergency Management Office, the amateur radio operators established a RACES group. Working together, the Emergency Management Agency and the members wrote a RACES plan to establish standard operating procedures for operation of RACES in the event of an emergency.

Discussion Question

Review the sample RACES plan included in Appendix D of your Student Manual. (Your instructor may direct you to review a different plan instead.)

Discuss the questions below:

• What are some components of the sample RACES plan that you particularly like?
• Consider the needs of your community. What would you need to include in a RACES plan to accommodate those needs?
Case Study – Part 5

Columbia County has made substantial efforts to incorporate amateur radio operators in its activities, using them for actual responses. The volunteers have proven their worth time and time again. For example, when the fire department repeater system failed, the hams’ repeaters were used. The second year the amateur radio volunteers participated in the annual fundraiser for the hospital, a runner collapsed during the race, and the ham operators called for help. The volunteers have also participated in community exercises such as disaster drills. In recognition of the volunteers’ contributions, “Honorary Citizen” awards were conferred on each of the members who had participated in events, and the group as a whole received an engraved plaque. Now, the amateur radio operators are actively involved in providing communications assistance not only for agencies throughout the county, but also with the State Emergency Management Office. They are assisting in the development of the State’s RACES program and helping grow similar programs in other counties, providing training and technical resources. The State coroner’s office has also provided specialized training to selected members of the group who now form the communications component of the coroner’s mass casualty response team. In this role, the hams’ ability to provide communications between agencies that otherwise do not have frequencies in common is particularly useful.

Amateur radio has provided essential communications and eased the overload that otherwise would have burdened the in-house communications resources of response agencies during many serious events, including floods, hazmat incidents, hostage situations, and forest fires. The Columbia County Director of Emergency Management now says she doesn’t know how they ever survived without amateur radio’s involvement.

Discussion Question

• What are the factors that contributed to the ultimate success of the amateur radio operators’ involvement in emergency management?
Appendix B: Title 47 CFR Part 97, Amateur Radio Service
Code of Federal Regulations

Title 47: Telecommunication

Part 97—Amateur Radio Service

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§ 97.3 Definitions.
§ 97.5 Station license required.
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§ 97.207 Space station.
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§ 97.313 Transmitter power standards.
§ 97.315 Certification of external RF power amplifiers.
§ 97.317 Standards for certification of external RF power amplifiers.

**Subpart E—Providing Emergency Communications**

§ 97.401 Operation during a disaster.
§ 97.403 Safety of life and protection of property.
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**Subpart F—Qualifying Examination Systems**

§ 97.501 Qualifying for an amateur operator license.
§ 97.503 Element standards.
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§ 97.507 Preparing an examination.
§ 97.509 Administering VE requirements.
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§ 97.525 Accrediting VEs.
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Appendix 1 to Part 97—Places Where the Amateur Service is Regulated by the FCC
Appendix 2 to Part 97—VEC Regions


Source: 54 FR 25857, June 20, 1989, unless otherwise noted.

Editorial Note: Nomenclature changes to part 97 appear at 63 FR 54077, Oct. 8, 1998.
§ 97.1: Basis and purpose.

The rules and regulations in this part are designed to provide an amateur radio service having a fundamental purpose as expressed in the following principles:

a. Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.

b. Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

c. Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communication and technical phases of the art.

d. Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts.

e. Continuation and extension of the amateur's unique ability to enhance international goodwill.

§ 97.3: Definitions.

(a) The definitions of terms used in part 97 are:

(1) Amateur operator. A person named in an amateur operator/primary license station grant on the ULS consolidated licensee database to be the control operator of an amateur station.

(2) Amateur radio services. The amateur service, the amateur-satellite service and the radio amateur civil emergency service.

(4) Amateur service. A radiocommunication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest.

(5) Amateur station. A station in an amateur radio service consisting of the apparatus necessary for carrying on radiocommunications.

(6) Automatic control. The use of devices and procedures for control of a station when it is transmitting so that compliance with the FCC Rules is achieved without the control operator being present at a control point.

(7) Auxiliary station. An amateur station, other than in a message forwarding system, that is transmitting communications point-to-point within a system of cooperating amateur stations.

(8) Bandwidth. The width of a frequency band outside of which the mean power of the transmitted signal is attenuated at least 26 dB below the mean power of the transmitted signal within the band.

(9) Beacon. An amateur station transmitting communications for the purposes of observation of propagation and reception or other related experimental activities.
(10) Broadcasting. Transmissions intended for reception by the general public, either direct or relayed.

(11) Call sign system. The method used to select a call sign for amateur station over-the-air identification purposes. The call sign systems are:

(i) Sequential call sign system. The call sign is selected by the FCC from an alphabetized list corresponding to the geographic region of the licensee's mailing address and operator class. The call sign is shown on the license. The FCC will issue public announcements detailing the procedures of the sequential call sign system.

(ii) Vanity call sign system. The call sign is selected by the FCC from a list of call signs requested by the licensee. The call sign is shown on the license. The FCC will issue public announcements detailing the procedures of the vanity call sign system.

(iii) Special event call sign system. The call sign is selected by the station licensee from a list of call signs shown on a common data base coordinated, maintained and disseminated by the amateur station special event call sign data base coordinators. The call sign must have the single letter prefix K, N or W, followed by a single numeral 0 through 9, followed by a single letter A through W or Y or Z (for example K1A). The special event call sign is substituted for the call sign shown on the station license grant while the station is transmitting. The FCC will issue public announcements detailing the procedures of the special event call sign system.


(13) Control operator. An amateur operator designated by the licensee of a station to be responsible for the transmissions from that station to assure compliance with the FCC Rules.

(14) Control point. The location at which the control operator function is performed.

(15) CSCE. Certificate of successful completion of an examination.

(16) Earth station. An amateur station located on, or within 50 km of, the Earth's surface intended for communications with space stations or with other Earth stations by means of one or more other objects in space.

(17) ) [Reserved]

(18) External RF power amplifier. A device capable of increasing power output when used in conjunction with, but not an integral part of, a transmitter.

(19) ) [Reserved]

(20) FAA. Federal Aviation Administration.

(21) FCC. Federal Communications Commission.

(22) Frequency coordinator. An entity, recognized in a local or regional area by amateur operators whose stations are eligible to be auxiliary or repeater stations, that recommends
transmit/receive channels and associated operating and technical parameters for such stations in order to avoid or minimize potential interference.

(23) Harmful interference. Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunication service operating in accordance with the Radio Regulations.

(24) IARP (International Amateur Radio Permit). A document issued pursuant to the terms of the Inter-American Convention on an International Amateur Radio Permit by a country signatory to that Convention, other than the United States. Montrouis, Haiti. AG/doc.3216/95.

(25) Indicator. Words, letters or numerals appended to and separated from the call sign during the station identification.

(26) Information bulletin. A message directed only to amateur operators consisting solely of subject matter of direct interest to the amateur service.


(28) ITU. International Telecommunication Union.

(29) Line A. Begins at Aberdeen, WA, running by great circle arc to the intersection of 48° N, 120° W, thence along parallel 48° N, to the intersection of 95° W, thence by great circle arc through the southermost point of Duluth, MN, thence by great circle arc to 45° N, 85° W, thence southward along meridian 85° W, to its intersection with parallel 41° N, thence along parallel 41° N, to its intersection with meridian 82° W, thence by great circle arc through the southermost point of Bangor, ME, thence by great circle arc through the southermost point of Searsport, ME, at which point it terminates.

(30) Local control. The use of a control operator who directly manipulates the operating adjustments in the station to achieve compliance with the FCC Rules.

(31) Message forwarding system. A group of amateur stations participating in a voluntary, cooperative, interactive arrangement where communications are sent from the control operator of an originating station to the control operator of one or more destination stations by one or more forwarding stations.

(32) National Radio Quiet Zone. The area in Maryland, Virginia and West Virginia Bounded by 39°15' N on the north, 78°30' W on the east, 37°30' N on the south and 80°30' W on the west.

(33) Physician. For the purpose of this part, a person who is licensed to practice in a place where the amateur service is regulated by the FCC, as either a Doctor of Medicine (M.D.) or a Doctor of Osteopathy (D.O.)

(34) Question pool. All current examination questions for a designated written examination element.

(35) Question set. A series of examination questions on a given examination selected from the question pool.

(36) Radio Regulations. The latest ITU Radio Regulations to which the United States is a party.
(37) RACES (radio amateur civil emergency service). A radio service using amateur stations for civil defense communications during periods of local, regional or national civil emergencies.

(38) Remote control. The use of a control operator who indirectly manipulates the operating adjustments in the station through a control link to achieve compliance with the FCC Rules.

(39) Repeater. An amateur station that simultaneously retransmits the transmission of another amateur station on a different channel or channels.

(40) Space station. An amateur station located more than 50 km above the Earth's surface.

(41) Space telemetry. A one-way transmission from a space station of measurements made from the measuring instruments in a spacecraft, including those relating to the functioning of the spacecraft.

(42) Spurious emission. An emission, or frequencies outside the necessary bandwidth of a transmission, the level of which may be reduced without affecting the information being transmitted.

(43) Telecommand. A one-way transmission to initiate, modify, or terminate functions of a device at a distance.

(44) Telecommand station. An amateur station that transmits communications to initiate, modify or terminate functions of a space station.

(45) Telemetry. A one-way transmission of measurements at a distance from the measuring instrument.

(46) Third party communications. A message from the control operator (first party) of an amateur station to another amateur station control operator (second party) on behalf of another person (third party).

(47) ULS (Universal Licensing System). The consolidated database, application filing system and processing system for all Wireless Telecommunications Services.

(48) VE. Volunteer examiner.

(49) VEC. Volunteer-examiner coordinator.

(b) The definitions of technical symbols used in this part are:

(1) EHF (extremely high frequency). The frequency range 30–300 GHz.

(2) HF (high frequency). The frequency range 3–30 MHz.

(3) Hz. Hertz.

(4) m. Meters.

(5) MF (medium frequency). The frequency range 300–3000 kHz.

(6) PEP (peak envelope power). The average power supplied to the antenna transmission line by a transmitter during one RF cycle at the crest of the modulation envelope taken under normal operating conditions.

(7) RF. Radio frequency.

(8) SHF (super-high frequency). The frequency range 3–30 GHz.
(9) UHF (ultra-high frequency). The frequency range 300–3000 MHz.

(10) VHF (very-high frequency). The frequency range 30–300 MHz.

(11) W. Watts.

(c) The following terms are used in this part to indicate emission types. Refer to §2.201 of the FCC Rules, Emission, modulation and transmission characteristics, for information on emission type designators.

(1) CW. International Morse code telegraphy emissions having designators with A, C, H, J or R as the first symbol; 1 as the second symbol; A or B as the third symbol; and emissions J2A and J2B.

(2) Data. Telemetry, telecommand and computer communications emissions having
   (i) designators with A, C, D, F, G, H, J or R as the first symbol, 1 as the second symbol, and D as the third symbol;
   (ii) emission J2D; and
   (iii) emissions A1C, F1C, F2C, J2C, and J3C having an occupied bandwidth of 500 Hz or less when transmitted on an amateur service frequency below 30 MHz. Only a digital code of a type specifically authorized in this part may be transmitted.

(3) Image. Facsimile and television emissions having designators with A, C, D, F, G, H, J or R as the first symbol; 1, 2 or 3 as the second symbol; C or F as the third symbol; and emissions having B as the first symbol; 7, 8 or 9 as the second symbol; W as the third symbol.

(4) MCW. Tone-modulated international Morse code telegraphy emissions having designators with A, C, D, F, G, H or R as the first symbol; 2 as the second symbol; A or B as the third symbol.

(5) Phone. Speech and other sound emissions having designators with A, C, D, F, G, H, J or R as the first symbol; 1, 2 or 3 as the second symbol; E as the third symbol. Also speech emissions having B as the first symbol; 7, 8 or 9 as the second symbol; E as the third symbol. MCW for the purpose of performing the station identification procedure, or for providing telegraphy practice interspersed with speech. Incidental tones for the purpose of selective calling or alerting or to control the level of a demodulated signal may also be considered phone.

(6) Pulse. Emissions having designators with K, L, M, P, Q, V or W as the first symbol; 0, 1, 2, 3, 7, 8, 9 or X as the second symbol; A, B, C, D, E, F, N, W or X as the third symbol.

(7) RTTY. Narrow-band direct-printing telegraphy emissions having designators with A, C, D, F, G, H, J or R as the first symbol; 1 as the second symbol; B as the third symbol; and emission J2B. Only a digital code of a type specifically authorized in this part may be transmitted.

(8) SS. Spread spectrum emissions using bandwidth-expansion modulation emissions having designators with A, C, D, F, G, H, J or R as the first symbol; X as the second symbol; X as the third symbol.
(9) Test. Emissions containing no information having the designators with N as the third symbol. Test does not include pulse emissions with no information or modulation unless pulse emissions are also authorized in the frequency band.


§ 97.5: Station license required.

(a) The station apparatus must be under the physical control of a person named in an amateur station license grant on the ULS consolidated license database or a person authorized for alien reciprocal operation by §97.107 of this part, before the station may transmit on any amateur service frequency from any place that is:

   (1) Within 50 km of the Earth's surface and at a place where the amateur service is regulated by the FCC;

   (2) Within 50 km of the Earth's surface and aboard any vessel or craft that is documented or registered in the United States; or

   (3) More than 50 km above the Earth's surface aboard any craft that is documented or registered in the United States.

(b) The types of station license grants are:

   (1) An operator/primary station license grant. One, but only one, operator/primary station license grant may be held by any one person. The primary station license is granted together with the amateur operator license. Except for a representative of a foreign government, any person who qualifies by examination is eligible to apply for an operator/primary station license grant.

   (2) A club station license grant. A club station license grant may be held only by the person who is the license trustee designated by an officer of the club. The trustee must be a person who holds an Amateur Extra, Advanced, General, Technician Plus, or Technician operator license grant. The club must be composed of at least four persons and must have a name, a document of organization, management, and a primary purpose devoted to amateur service activities consistent with this part.

   (3) A military recreation station license grant. A military recreation station license grant may be held only by the person who is the license custodian designated by the official in charge of the United States military recreational premises where the station is situated. The person must not be a representative of a foreign government. The person need not hold an amateur operator license grant.

   (4) A RACES station license grant. A RACES station license grant may be held only by the person who is the license custodian designated by the official responsible for the governmental agency served by that civil defense organization. The custodian must be
the civil defense official responsible for coordination of all civil defense activities in the
area concerned. The custodian must not be a representative of a foreign government. The
custodian need not hold an amateur operator license grant.

(c) The person named in the station license grant or who is authorized for alien reciprocal
operation by §97.107 of this part may use, in accordance with the applicable rules of this part,
the transmitting apparatus under the physical control of the person at places where the amateur
service is regulated by the FCC.

(d) A CEPT radio-amateur license is issued to the person by the country of which the person is a
citizen. The person must not:

1. Be a resident alien or citizen of the United States, regardless of any other citizenship
   also held;
2. Hold an FCC-issued amateur operator license nor reciprocal permit for alien amateur
   licensee;
3. Be a prior amateur service licensee whose FCC-issued license was revoked,
suspended for less than the balance of the license term and the suspension is still in
effect, suspended for the balance of the license term and relicensing has not taken place,
or surrendered for cancellation following notice of revocation, suspension or monetary
   forfeiture proceedings; or
4. Be the subject of a cease and desist order that relates to amateur service operation and
   which is still in effect.

(e) An IARP is issued to the person by the country of which the person is a citizen. The person
must not:

1. Be a resident alien or citizen of the United States, regardless of any other citizenship
   also held;
2. Hold an FCC-issued amateur operator license nor reciprocal permit for alien amateur
   licensee;
3. Be a prior amateur service licensee whose FCC-issued license was revoked,
suspended for less than the balance of the license term and the suspension is still in
effect, suspended for the balance of the license term and relicensing has not taken place,
or surrendered for cancellation following notice of revocation, suspension or monetary
   forfeiture proceedings; or
4. Be the subject of a cease and desist order that relates to amateur service operation and
   which is still in effect.

1998]

§ 97.7: Control operation required.

When transmitting, each amateur station must have a control operator. The control operator must
be a person:
(a) For whom an amateur operator/primary station license grant appears on the ULS consolidated licensee database, or
(b) Who is authorized for alien reciprocal operation by §97.107 of this part.

[63 FR 68978, Dec. 14, 1998]

§ 97.9: Operator license grant.

(a) The classes of amateur operator license grants are: Novice, Technician, Technician Plus (until such licenses expire, a Technical Class license granted before February 14, 1991, is considered a Technician Plus Class license), General, Advanced, and Amateur Extra. The person named in the operator license grant is authorized to be the control operator of an amateur station with the privileges authorized to the operator class specified on the license grant.

(b) The person named in an operator license grant of Novice, Technician, Technician Plus, General or Advanced Class, who has properly submitted to the administering VEs a FCC Form 605 document requesting examination for an operator license grant of a higher class, and who holds a CSCE indicating that the person has completed the necessary examinations within the previous 365 days, is authorized to exercise the rights and privileges of the higher operator class until final disposition of the application or until 365 days following the passing of the examination, whichever comes first.


§ 97.11: Stations aboard ships or aircraft.

(a) The installation and operation of an amateur station on a ship or aircraft must be approved by the master of the ship or pilot in command of the aircraft.

(b) The station must be separate from and independent of all other radio apparatus installed on the ship or aircraft, except a common antenna may be shared with a voluntary ship radio installation. The station's transmissions must not cause interference to any other apparatus installed on the ship or aircraft.

(c) The station must not constitute a hazard to the safety of life or property. For a station aboard an aircraft, the apparatus shall not be operated while the aircraft is operating under Instrument Flight Rules, as defined by the FAA, unless the station has been found to comply with all applicable FAA Rules.

§ 97.13: Restrictions on station location.

(a) Before placing an amateur station on land of environmental importance or that is significant in American history, architecture or culture, the licensee may be required to take certain actions prescribed by §§1.1305–1.1319 of this chapter.

(b) A station within 1600 m (1 mile) of an FCC monitoring facility must protect that facility from harmful interference. Failure to do so could result in imposition of operating restrictions.
upon the amateur station by a District Director pursuant to §97.121 of this part. Geographical coordinates of the facilities that require protection are listed in §0.121(c) of this chapter.

(c) Before causing or allowing an amateur station to transmit from any place where the operation of the station could cause human exposure to RF electromagnetic field levels in excess of those allowed under §1.1310 of this chapter, the licensee is required to take certain actions.

   (1) The licensee must perform the routine RF environmental evaluation prescribed by §1.1307(b) of this chapter, if the power of the licensee's station exceeds the limits given in the following table:

<table>
<thead>
<tr>
<th>Wavelength band</th>
<th>Evaluation required if power (watts) exceeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF</td>
<td></td>
</tr>
<tr>
<td>160 m</td>
<td>500</td>
</tr>
<tr>
<td>HF</td>
<td></td>
</tr>
<tr>
<td>80 m</td>
<td>500</td>
</tr>
<tr>
<td>75 m</td>
<td>500</td>
</tr>
<tr>
<td>40 m</td>
<td>500</td>
</tr>
<tr>
<td>30 m</td>
<td>425</td>
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<tr>
<td>20 m</td>
<td>225</td>
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<tr>
<td>17 m</td>
<td>125</td>
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<tr>
<td>15 m</td>
<td>100</td>
</tr>
<tr>
<td>12 m</td>
<td>75</td>
</tr>
<tr>
<td>10 m</td>
<td>50</td>
</tr>
<tr>
<td>VHF (all bands)</td>
<td>50</td>
</tr>
<tr>
<td>UHF</td>
<td></td>
</tr>
<tr>
<td>Wavelength band</td>
<td>Evaluation required if power(^1)(watts) exceeds</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>70 cm</td>
<td>70</td>
</tr>
<tr>
<td>33 cm</td>
<td>150</td>
</tr>
<tr>
<td>23 cm</td>
<td>200</td>
</tr>
<tr>
<td>13 cm</td>
<td>250</td>
</tr>
<tr>
<td>SHF (all bands)</td>
<td>250</td>
</tr>
<tr>
<td>EHF (all bands)</td>
<td>250</td>
</tr>
<tr>
<td>Repeater stations (all bands)</td>
<td><em>non-building-mounted antennas</em>: height above ground level to lowest point of antenna &lt;10 m and power &gt;500 W ERP <em>building-mounted antennas</em>: power &gt;500 W ERP</td>
</tr>
</tbody>
</table>

\(^1\)Power = PEP input to antenna except, for repeater stations only, power exclusion is based on ERP (effective radiated power).

(2) ) If the routine environmental evaluation indicates that the RF electromagnetic fields could exceed the limits contained in §1.1310 of this chapter in accessible areas, the licensee must take action to prevent human exposure to such RF electromagnetic fields. Further information on evaluating compliance with these limits can be found in the FCC's OET Bulletin Number 65, “Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields.”


§ 97.15: Station antenna structures.

(a) Owners of certain antenna structures more than 60.96 meters (200 feet) above ground level at the site or located near or at a public use airport must notify the Federal Aviation Administration and register with the Commission as required by part 17 of this chapter.

(b) Except as otherwise provided herein, a station antenna structure may be erected at heights and dimensions sufficient to accommodate amateur service communications. (State and local regulation of a station antenna structure must not preclude amateur service communications. Rather, it must reasonably accommodate such communications and must constitute the minimum
practicable regulation to accomplish the state or local authority's legitimate purpose. See PRB–1, 101 FCC 2d 952 (1985) for details.)

[64 FR 53242, Oct. 1, 1999]

§ 97.17: Application for new license grant.

(a) Any qualified person is eligible to apply for a new operator/primary station, club station or military recreation station license grant. No new license grant will be issued for a Novice, Technician Plus, or Advanced Class operator/primary station or a RACES station.

(b) Each application for a new amateur service license grant must be filed with the FCC as follows:

(1) Each candidate for an amateur radio operator license which requires the applicant to pass one or more examination elements must present the administering VEs with all information required by the rules prior to the examination. The VEs may collect all necessary information in any manner of their choosing, including creating their own forms.

(2) For a new club or military recreation station license grant, each applicant must present all information required by the rules to an amateur radio organization having tax-exempt status under section 501(c)(3) of the Internal Revenue Code of 1986 that provides voluntary, uncompensated and unreimbursed services in providing club and military recreation station call signs (“Club Station Call Sign Administrator”) who must submit the information to the FCC in an electronic batch file. The Club Station Call Sign Administrator may collect the information required by these rules in any manner of their choosing, including creating their own forms. The Club Station Call Sign Administrator must retain the applicants information for at least 15 months and make it available to the FCC upon request. The FCC will issue public announcements listing the qualified organizations that have completed a pilot autogrant batch filing project and are authorized to serve as a Club Station Call Sign Administrator.

(c) No person shall obtain or attempt to obtain, or assist another person to obtain or attempt to obtain, an amateur service license grant by fraudulent means.

(d) One unique call sign will be shown on the license grant of each new primary, club and military recreation station. The call sign will be selected by the sequential call sign system.


§ 97.19: Application for a vanity call sign.

(a) The person named in an operator/primary station license grant or in a club station license grant is eligible to make application for modification of the license grant, or the renewal thereof, to show a call sign selected by the vanity call sign system. RACES and military recreation stations are not eligible for a vanity call sign.
(b) Each application for a modification of an operator/primary or club station license grant, or the renewal thereof, to show a call sign selected by the vanity call sign system must be filed in accordance with §1.913 of this chapter.

(c) Unassigned call signs are available to the vanity call sign system with the following exceptions:

1. A call sign shown on an expired license grant is not available to the vanity call sign system for 2 years following the expiration of the license.
2. A call sign shown on a surrendered, revoked, set aside, canceled, or voided license grant is not available to the vanity call sign system for 2 years following the date such action is taken.
3. Except for an applicant who is the spouse, child, grandchild, stepchild, parent, grandparent, step-parent, brother, sister, stepbrother, stepsister, aunt, uncle, niece, nephew, or in-law, and except for an applicant who is a club station license trustee acting with a written statement of consent signed by either the licensee ante mortem but who is now deceased or by at least one relative, as listed above, of the person now deceased, the call sign shown on the license of the person now deceased is not available to the vanity call sign system for 2 years following the person's death, or for 2 years following the expiration of the license grant, whichever is sooner.

(d) The vanity call sign requested by an applicant must be selected from the group of call signs corresponding to the same or lower class of operator license held by the applicant as designated in the sequential call sign system.

1. The applicant must request that the call sign shown on the license grant be vacated and provide a list of up to 25 call signs in order of preference. In the event that the Commission receives more than one application requesting a vanity call sign from an applicant on the same receipt day, the Commission will process only the first such application entered into the Universal Licensing System. Subsequent vanity call sign applications from that applicant with the same receipt date will not be accepted.
2. The first assignable call sign from the applicant's list will be shown on the license grant. When none of those call signs are assignable, the call sign vacated by the applicant will be shown on the license grant.
3. Vanity call signs will be selected from those call signs assignable at the time the application is processed by the FCC.
4. A call sign designated under the sequential call sign system for Alaska, Hawaii, Caribbean Insular Areas, and Pacific Insular areas will be assigned only to a primary or club station whose licensee's mailing address is in the corresponding state, commonwealth, or island. This limitation does not apply to an applicant for the call sign as the spouse, child, grandchild, stepchild, parent, grandparent, stepparent, brother, sister, stepbrother, stepsister, aunt, uncle, niece, nephew, or in-law, of the former holder now deceased.

§ 97.21: Application for a modified or renewed license grant.

(a) A person holding a valid amateur station license grant:

(1) Must apply to the FCC for a modification of the license grant as necessary to show the correct mailing address, licensee name, club name, license trustee name or license custodian name in accordance with §1.913 of this chapter. For a club, military recreation or RACES station license grant, it must be presented in document form to a Club Station Call Sign Administrator who must submit the information thereon to the FCC in an electronic batch file. The Club Station Call Sign Administrator must retain the collected information for at least 15 months and make it available to the FCC upon request.

(2) May apply to the FCC for a modification of the operator/primary station license grant to show a higher operator class. Applicants must present the administering VEs with all information required by the rules prior to the examination. The VEs may collect all necessary information in any manner of their choosing, including creating their own forms.

(3) May apply to the FCC for renewal of the license grant for another term in accordance with §1.913 of this chapter. Application for renewal of a Technician Plus Class operator/primary station license will be processed as an application for renewal of a Technician Class operator/primary station license.

(i) For a station license grant showing a call sign obtained through the vanity call sign system, the application must be filed in accordance with §97.19 of this Part in order to have the vanity call sign reassigned to the station.

(ii) or a primary station license grant showing a call sign obtained through the sequential call sign system, and for a primary station license grant showing a call sign obtained through the vanity call sign system but whose grantee does not want to have the vanity call sign reassigned to the station, the application must be filed with the FCC in accordance with §1.913 of this chapter. When the application has been received by the FCC on or before the license expiration date, the license operating authority is continued until the final disposition of the application.

(iii) or a club station or military recreation station license grant showing a call sign obtained through the sequential call sign system, and for a club or military recreation station license grant showing a call sign obtained through the vanity call sign system but whose grantee does not want to have the vanity call sign reassigned to the station, the application must be presented in document form to a Club Station Call Sign Administrator who must submit the information thereon to the FCC in an electronic batch file. The Club Station Call Sign Administrator must retain the collected information for at least 15 months and make it available to the FCC upon request. RACES station license grants will not be renewed.

(b) A person whose amateur station license grant has expired may apply to the FCC for renewal of the license grant for another term during a 2 year filing grace period. The application must be received at the address specified above prior to the end of the grace period. Unless and until the license grant is renewed, no privileges in this Part are conferred.

(c) A call sign obtained under the sequential or vanity call sign system will be reassigned to the station upon renewal or modification of a station license.
§ 97.23: Mailing address.

Each license grant must show the grantee's correct name and mailing address. The mailing address must be in an area where the amateur service is regulated by the FCC and where the grantee can receive mail delivery by the United States Postal Service. Revocation of the station license or suspension of the operator license may result when correspondence from the FCC is returned as undeliverable because the grantee failed to provide the correct mailing address.

[63 FR 68979, Dec. 14, 1998]

§ 97.25: License term.

An amateur service license is normally granted for a 10-year term.

[63 FR 68979, Dec. 14, 1998]

§ 97.27: FCC modification of station license grant.

(a) The FCC may modify a station license grant, either for a limited time or for the duration of the term thereof, if it determines:

(1) That such action will promote the public interest, convenience, and necessity; or

(2) That such action will promote fuller compliance with the provisions of the Communications Act of 1934, as amended, or of any treaty ratified by the United States.

(b) When the FCC makes such a determination, it will issue an order of modification. The order will not become final until the licensee is notified in writing of the proposed action and the grounds and reasons therefor. The licensee will be given reasonable opportunity of no less than 30 days to protest the modification; except that, where safety of life or property is involved, a shorter period of notice may be provided. Any protest by a licensee of an FCC order of modification will be handled in accordance with the provisions of 47 U.S.C. 316.


§ 97.29: Replacement license grant document.

Each grantee whose amateur station license grant document is lost, mutilated or destroyed may apply to the FCC for a replacement in accordance with §1.913 of this chapter.

[63 FR 68979, Dec. 14, 1998]
§ 97.101: General standards.

(a) In all respects not specifically covered by FCC Rules each amateur station must be operated in accordance with good engineering and good amateur practice.

(b) Each station licensee and each control operator must cooperate in selecting transmitting channels and in making the most effective use of the amateur service frequencies. No frequency will be assigned for the exclusive use of any station.

(c) At all times and on all frequencies, each control operator must give priority to stations providing emergency communications, except to stations transmitting communications for training drills and tests in RACES.

(d) No amateur operator shall willfully or maliciously interfere with or cause interference to any radio communication or signal.

§ 97.103: Station licensee responsibilities.

(a) The station licensee is responsible for the proper operation of the station in accordance with the FCC Rules. When the control operator is a different amateur operator than the station licensee, both persons are equally responsible for proper operation of the station.

(b) The station licensee must designate the station control operator. The FCC will presume that the station licensee is also the control operator, unless documentation to the contrary is in the station records.

(c) The station licensee must make the station and the station records available for inspection upon request by an FCC representative. When deemed necessary by a District Director to assure compliance with the FCC Rules, the station licensee must maintain a record of station operations containing such items of information as the District Director may require in accord with §0.314(x) of the FCC Rules.

[54 FR 25857, June 20, 1989, as amended at 71 FR 66462, Nov. 15, 2006]

§ 97.105: Control operator duties.

(a) The control operator must ensure the immediate proper operation of the station, regardless of the type of control.

(b) A station may only be operated in the manner and to the extent permitted by the privileges authorized for the class of operator license held by the control operator.

§ 97.107: Reciprocal operating authority.

A non-citizen of the United States (“alien”) holding an amateur service authorization granted by the alien's government is authorized to be the control operator of an amateur station located at places where the amateur service is regulated by the FCC, provided there is in effect a multilateral or bilateral reciprocal operating arrangement, to which the United States and the
alien's government are parties, for amateur service operation on a reciprocal basis. The FCC will issue public announcements listing the countries with which the United States has such an arrangement. No citizen of the United States or person holding an FCC amateur operator/primary station license grant is eligible for the reciprocal operating authority granted by this section. The privileges granted to a control operator under this authorization are:

(a) For an amateur service license granted by the Government of Canada:

   (1) The terms of the Convention Between the United States and Canada (TIAS No. 2508) Relating to the Operation by Citizens of Either Country of Certain Radio Equipment or Stations in the Other Country;
   
   (2) The operating terms and conditions of the amateur service license issued by the Government of Canada; and
   
   (3) The applicable rules of this part, but not to exceed the control operator privileges of an FCC-granted Amateur Extra Class operator license.

(b) For an amateur service license granted by any country, other than Canada, with which the United States has a multilateral or bilateral agreement:

   (1) The terms of the agreement between the alien's government and the United States;
   
   (2) The operating terms and conditions of the amateur service license granted by the alien's government;
   
   (3) The applicable rules of this part, but not to exceed the control operator privileges of an FCC-granted Amateur Extra Class operator license; and

(c) At any time the FCC may, in its discretion, modify, suspend or cancel the reciprocal operating authority granted to any person by this section.

[63 FR 68979, Dec. 14, 1998]

§ 97.109: Station control.

(a) Each amateur station must have at least one control point.

(b) When a station is being locally controlled, the control operator must be at the control point. Any station may be locally controlled.

(c) When a station is being remotely controlled, the control operator must be at the control point. Any station may be remotely controlled.

(d) When a station is being automatically controlled, the control operator need not be at the control point. Only stations specifically designated elsewhere in this part may be automatically controlled. Automatic control must cease upon notification by a District Director that the station is transmitting improperly or causing harmful interference to other stations. Automatic control must not be resumed without prior approval of the District Director.

§ 97.111: Authorized transmissions.

(a) An amateur station may transmit the following types of two-way communications:

   (1) Transmissions necessary to exchange messages with other stations in the amateur service, except those in any country whose administration has notified the ITU that it objects to such communications. The FCC will issue public notices of current arrangements for international communications.

   (2) Transmissions necessary to meet essential communication needs and to facilitate relief actions.

   (3) Transmissions necessary to exchange messages with a station in another FCC-regulated service while providing emergency communications;

   (4) Transmissions necessary to exchange messages with a United States government station, necessary to providing communications in RACES; and

   (5) Transmissions necessary to exchange messages with a station in a service not regulated by the FCC, but authorized by the FCC to communicate with amateur stations. An amateur station may exchange messages with a participating United States military station during an Armed Forces Day Communications Test.

(b) In addition to one-way transmissions specifically authorized elsewhere in this part, an amateur station may transmit the following types of one-way communications:

   (1) Brief transmissions necessary to make adjustments to the station;

   (2) Brief transmissions necessary to establishing two-way communications with other stations;

   (3) Telecommand;

   (4) Transmissions necessary to providing emergency communications;

   (5) Transmissions necessary to assisting persons learning, or improving proficiency in, the international Morse code; and

   (6) Transmissions necessary to disseminate information bulletins.

   (7) Transmissions of telemetry.


§ 97.113: Prohibited transmissions

(a) No amateur station shall transmit:

   (1) Communications specifically prohibited elsewhere in this part;

   (2) Communications for hire or for material compensation, direct or indirect, paid or promised, except as otherwise provided in these rules;

   (3) Communications in which the station licensee or control operator has a pecuniary interest, including communications on behalf of an employer. Amateur operators may, however, notify other amateur operators of the availability for sale or trade of apparatus
normally used in an amateur station, provided that such activity is not conducted on a regular basis;

(4) Music using a phone emission except as specifically provided elsewhere in this section; communications intended to facilitate a criminal act; messages encoded for the purpose of obscuring their meaning, except as otherwise provided herein; obscene or indecent words or language; or false or deceptive messages, signals or identification.

(5) Communications, on a regular basis, which could reasonably be furnished alternatively through other radio services.

(b) An amateur station shall not engage in any form of broadcasting, nor may an amateur station transmit one-way communications except as specifically provided in these rules; nor shall an amateur station engage in any activity related to program production or news gathering for broadcasting purposes, except that communications directly related to the immediate safety of human life or the protection of property may be provided by amateur stations to broadcasters for dissemination to the public where no other means of communication is reasonably available before or at the time of the event.

(c) A control operator may accept compensation as an incident of a teaching position during periods of time when an amateur station is used by that teacher as a part of classroom instruction at an educational institution.

(d) The control operator of a club station may accept compensation for the periods of time when the station is transmitting telegraphy practice or information bulletins, provided that the station transmits such telegraphy practice and bulletins for at least 40 hours per week; schedules operations on at least six amateur service MF and HF bands using reasonable measures to maximize coverage; where the schedule of normal operating times and frequencies is published at least 30 days in advance of the actual transmissions; and where the control operator does not accept any direct or indirect compensation for any other service as a control operator.

(e) No station shall retransmit programs or signals emanating from any type of radio station other than an amateur station, except propagation and weather forecast information intended for use by the general public and originated from United States Government stations, and communications, including incidental music, originating on United States Government frequencies between a manned spacecraft and its associated Earth stations. Prior approval for manned spacecraft communications retransmissions must be obtained from the National Aeronautics and Space Administration. Such retransmissions must be for the exclusive use of amateur radio operators. Propagation, weather forecasts, and manned spacecraft communications retransmissions may not be conducted on a regular basis, but only occasionally, as an incident of normal amateur radio communications.

(f) No amateur station, except an auxiliary, repeater, or space station, may automatically retransmit the radio signals of other amateur station.


§ 97.115: Third party communications.

(a) An amateur station may transmit messages for a third party to:
(1) Any station within the jurisdiction of the United States.

(2) Any station within the jurisdiction of any foreign government when transmitting emergency or disaster relief communications and any station within the jurisdiction of any foreign government whose administration has made arrangements with the United States to allow amateur stations to be used for transmitting international communications on behalf of third parties. No station shall transmit messages for a third party to any station within the jurisdiction of any foreign government whose administration has not made such an arrangement. This prohibition does not apply to a message for any third party who is eligible to be a control operator of the station.

(b) The third party may participate in stating the message where:

(1) The control operator is present at the control point and is continuously monitoring and supervising the third party's participation; and

(2) The third party is not a prior amateur service licensee whose license was revoked or not renewed after hearing and re-licensing has not taken place; suspended for less than the balance of the license term and the suspension is still in effect; suspended for the balance of the license term and re-licensing has not taken place; or surrendered for cancellation following notice of revocation, suspension or monetary forfeiture proceedings. The third party may not be the subject of a cease and desist order which relates to amateur service operation and which is still in effect.

(c) No station may transmit third party communications while being automatically controlled except a station transmitting a RTTY or data emission.

(d) At the end of an exchange of international third party communications, the station must also transmit in the station identification procedure the call sign of the station with which a third party message was exchanged.


§ 97.117: International communications.

Transmissions to a different country, where permitted, shall be limited to communications incidental to the purposes of the amateur service and to remarks of a personal character.

[71 FR 25982, May 3, 2006]

§ 97.119: Station identification.

(a) Each amateur station, except a space station or telecommand station, must transmit its assigned call sign on its transmitting channel at the end of each communication, and at least every 10 minutes during a communication, for the purpose of clearly making the source of the transmissions from the station known to those receiving the transmissions. No station may transmit unidentified communications or signals, or transmit as the station call sign, any call sign not authorized to the station.
(b) The call sign must be transmitted with an emission authorized for the transmitting channel in one of the following ways:

(1) By a CW emission. When keyed by an automatic device used only for identification, the speed must not exceed 20 words per minute;

(2) By a phone emission in the English language. Use of a phonetic alphabet as an aid for correct station identification is encouraged;

(3) By a RTTY emission using a specified digital code when all or part of the communications are transmitted by a RTTY or data emission;

(4) By an image emission conforming to the applicable transmission standards, either color or monochrome, of §73.682(a) of the FCC Rules when all or part of the communications are transmitted in the same image emission.

(c) One or more indicators may be included with the call sign. Each indicator must be separated from the call sign by the slant mark (/) or by any suitable word that denotes the slant mark. If an indicator is self-assigned, it must be included before, after, or both before and after, the call sign. No self-assigned indicator may conflict with any other indicator specified by the FCC Rules or with any prefix assigned to another country.

(d) When transmitting in conjunction with an event of special significance, a station may substitute for its assigned call sign a special event call sign as shown for that station for that period of time on the common data base coordinated, maintained and disseminated by the special event call sign data base coordinators. Additionally, the station must transmit its assigned call sign at least once per hour during such transmissions.

(e) When the operator license class held by the control operator exceeds that of the station licensee, an indicator consisting of the call sign assigned to the control operator's station must be included after the call sign.

(f) When the control operator is a person who is exercising the rights and privileges authorized by §97.9(b) of this part, an indicator must be included after the call sign as follows:

(1) For a control operator who has requested a license modification from Novice Class to Technical Class: KT;

(2) For a control operator who has requested a license modification from Novice, Technician, or Technician Plus Class to General Class: AG;

(3) For a control operator who has requested a license modification from Novice, Technician, Technician Plus, General, or Advanced Class to Amateur Extra Class: AE.

(g) When the station is transmitting under the authority of §97.107 of this part, an indicator consisting of the appropriate letter-numeral designating the station location must be included before the call sign that was issued to the station by the country granting the license. For an amateur service license granted by the Government of Canada, however, the indicator must be included after the call sign. At least once during each intercommunication, the identification announcement must include the geographical location as nearly as possible by city and state, commonwealth or possession.

§ 97.121: Restricted operation.

(a) If the operation of an amateur station causes general interference to the reception of transmissions from stations operating in the domestic broadcast service when receivers of good engineering design, including adequate selectivity characteristics, are used to receive such transmissions, and this fact is made known to the amateur station licensee, the amateur station shall not be operated during the hours from 8 p.m. to 10:30 p.m., local time, and on Sunday for the additional period from 10:30 a.m. until 1 p.m., local time, upon the frequency or frequencies used when the interference is created.

(b) In general, such steps as may be necessary to minimize interference to stations operating in other services may be required after investigation by the FCC.
§ 97.201: Auxiliary station.

(a) Any amateur station licensed to a holder of a Technician, Technician Plus, General, Advanced or Amateur Extra Class operator license may be an auxiliary station. A holder of a Technician, Technician Plus, General, Advanced or Amateur Extra Class operator license may be the control operator of an auxiliary station, subject to the privileges of the class of operator license held.

(b) An auxiliary station may transmit only on the 2 m and shorter wavelength bands, except the 144.0–144.5 MHz, 145.8–146.0 MHz, 219–220 MHz, 222.00–222.15 MHz, 431–433 MHz, and 435–438 MHz segments.

(c) Where an auxiliary station causes harmful interference to another auxiliary station, the licensees are equally and fully responsible for resolving the interference unless one station's operation is recommended by a frequency coordinator and the other station's is not. In that case, the licensee of the non-coordinated auxiliary station has primary responsibility to resolve the interference.

(d) An auxiliary station may be automatically controlled. (e) An auxiliary station may transmit one-way communications.


§ 97.203: Beacon station.

(a) Any amateur station licensed to a holder of a Technician, Technician Plus, General, Advanced or Amateur Extra Class operator license may be a beacon. A holder of a Technician, Technician Plus, General, Advanced or Amateur Extra Class operator license may be the control operator of a beacon, subject to the privileges of the class of operator license held.

(b) A beacon must not concurrently transmit on more than 1 channel in the same amateur service frequency band, from the same station location.

(c) The transmitter power of a beacon must not exceed 100 W.

(d) A beacon may be automatically controlled while it is transmitting on the 28.20–28.30 MHz, 50.06–50.08 MHz, 144.275–144.300 MHz, 222.05–222.06 MHz or 432.300–432.400 MHz segments, or on the 33 cm and shorter wavelength bands.

(e) Before establishing an automatically controlled beacon in the National Radio Quiet Zone or before changing the transmitting frequency, transmitter power, antenna height or directivity, the station licensee must give written notification thereof to the Interference Office, National Radio Astronomy Observatory, P.O. Box 2, Green Bank, WV 24944.

(1) The notification must include the geographical coordinates of the antenna, antenna ground elevation above mean sea level (AMSL), antenna center of radiation above ground level (AGL), antenna directivity, proposed frequency, type of emission, and transmitter power.

(2) If an objection to the proposed operation is received by the FCC from the National Radio Astronomy Observatory at Green Bank, Pocahontas County, WV, for itself or
behalf of the Naval Research Laboratory at Sugar Grove, Pendleton County, WV, within 20 days from the date of notification, the FCC will consider all aspects of the problem and take whatever action is deemed appropriate.

(f) A beacon must cease transmissions upon notification by a District Director that the station is operating improperly or causing undue interference to other operations. The beacon may not resume transmitting without prior approval of the District Director.

(g) A beacon may transmit one-way communications.

§ 97.205: Repeater station.

(a) Any amateur station licensed to a holder of a Technician, General, Advanced or Amateur Extra Class operator license may be a repeater. A holder of a Technician, General, Advanced or Amateur Extra Class operator license may be the control operator of a repeater, subject to the privileges of the class of operator license held.

(b) A repeater may receive and retransmit only on the 10 m and shorter wavelength frequency bands except the 28.0–29.5 MHz, 50.0–51.0 MHz, 144.0–144.5 MHz, 145.5–146.0 MHz, 222.00–222.15 MHz, 431.0–433.0 Mhz, and 435.0–438.0 Mhz segments.

(c) Where the transmissions of a repeater cause harmful interference to another repeater, the two station licensees are equally and fully responsible for resolving the interference unless the operation of one station is recommended by a frequency coordinator and the operation of the other station is not. In that case, the licensee of the non-coordinated repeater has primary responsibility to resolve the interference.

(d) A repeater may be automatically controlled.

(e) Ancillary functions of a repeater that are available to users on the input channel are not considered remotely controlled functions of the station. Limiting the use of a repeater to only certain user stations is permissible.

(f) [Reserved]

(g) The control operator of a repeater that retransmits inadvertently communications that violate the rules in this part is not accountable for the violative communications.

(h) The provisions of this paragraph do not apply to repeaters that transmit on the 1.2 cm or shorter wavelength bands. Before establishing a repeater within 16 km (10 miles) of the Arecibo Observatory or before changing the transmitting frequency, transmitter power, antenna height or directivity of an existing repeater, the station licensee must give written notification thereof to the Interference Office, Arecibo Observatory, HC3 Box 53995, Arecibo, Puerto Rico 00612, in writing or electronically, of the technical parameters of the proposal. Licensees who choose to transmit information electronically should e-mail to: prcz@naic.edu.

(1) The notification shall state the geographical coordinates of the antenna (NAD–83 datum), antenna height above mean sea level (AMSL), antenna center of radiation above ground level (AGL), antenna directivity and gain, proposed frequency and FCC Rule...
Part, type of emission, effective radiated power, and whether the proposed use is itinerant. Licensees may wish to consult interference guidelines provided by Cornell University.

(2) If an objection to the proposed operation is received by the FCC from the Arecibo Observatory, Arecibo, Puerto Rico, within 20 days from the date of notification, the FCC will consider all aspects of the problem and take whatever action is deemed appropriate. The licensee will be required to make reasonable efforts in order to resolve or mitigate any potential interference problem with the Arecibo Observatory.


§ 97.207: Space station.

(a) Any amateur station may be a space station. A holder of any class operator license may be the control operator of a space station, subject to the privileges of the class of operator license held by the control operator.

(b) A space station must be capable of effecting a cessation of transmissions by telecommand whenever such cessation is ordered by the FCC.

(c) The following frequency bands and segments are authorized to space stations:
   (1) The 17 m, 15 m, 12 m, and 10 m bands, 6 mm, 4 mm, 2 mm and 1 mm bands; and
   (2) The 7.0–7.1 MHz, 14.00–14.25 MHz, 144–146 MHz, 435–438 MHz, 1260–1270 MHz, and 2400–2450 MHz, 3.40–3.41 GHz, 5.83–5.85 GHz, 10.45–10.50 GHz, and 24.00–24.05 GHz segments.

(d) A space station may automatically retransmit the radio signals of Earth stations and other space stations.

(e) A space station may transmit one-way communications.

(f) Space telemetry transmissions may consist of specially coded messages intended to facilitate communications or related to the function of the spacecraft.

(g) The license grantee of each space station must make the following written notifications to the International Bureau, FCC, Washington, DC 20554.

(1) A pre-space notification within 30 days after the date of launch vehicle determination, but no later than 90 days before integration of the space station into the launch vehicle. The notification must be in accordance with the provisions of Articles 9 and 11 of the International Telecommunication Union (ITU) Radio Regulations and must specify the information required by Appendix 4 and Resolution No. 642 of the ITU Radio Regulations. The notification must also include a description of the design and operational strategies that the space station will use to mitigate orbital debris, including the following information:

   (i ) A statement that the space station licensee has assessed and limited the amount of debris released in a planned manner during normal operations, and has
assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal;

(ii) A statement that the space station licensee has assessed and limited the probability of accidental explosions during and after completion of mission operations. This statement must include a demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft. Energy sources include chemical, pressure, and kinetic energy. This demonstration should address whether stored energy will be removed at the spacecraft's end of life, by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy, or through other equivalent procedures specifically disclosed in the application;

(iii) A statement that the space station licensee has assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations. Where a space station will be launched into a low-Earth orbit that is identical, or very similar, to an orbit used by other space stations, the statement must include an analysis of the potential risk of collision and a description of what measures the space station operator plans to take to avoid in-orbit collisions. If the space station licensee is relying on coordination with another system, the statement must indicate what steps have been taken to contact, and ascertain the likelihood of successful coordination of physical operations with, the other system. The statement must disclose the accuracy—if any—with which orbital parameters of non-geostationary satellite orbit space stations will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s). In the event that a system is not able to maintain orbital tolerances, i.e., it lacks a propulsion system for orbital maintenance, that fact should be included in the debris mitigation disclosure. Such systems must also indicate the anticipated evolution over time of the orbit of the proposed satellite or satellites. Where a space station requests the assignment of a geostationary-Earth orbit location, it must assess whether there are any known satellites located at, or reasonably expected to be located at, the requested orbital location, or assigned in the vicinity of that location, such that the station keeping volumes of the respective satellites might overlap. If so, the statement must include a statement as to the identities of those parties and the measures that will be taken to prevent collisions;

(iv) A statement detailing the post-mission disposal plans for the space station at end of life, including the quantity of fuel—if any—that will be reserved for post-mission disposal maneuvers. For geostationary-Earth orbit space stations, the statement must disclose the altitude selected for a post-mission disposal orbit and the calculations that are used in deriving the disposal altitude. The statement must also include a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the space station. In general, an assessment should include an estimate as to whether portions of the spacecraft will survive re-entry.
and reach the surface of the Earth, as well as an estimate of the resulting probability of human casualty.

(v) If any material item described in this notification changes before launch, a replacement pre-space notification shall be filed with the International Bureau no later than 90 days before integration of the space station into the launch vehicle.

(2) An in-space station notification is required no later than 7 days following initiation of space station transmissions. This notification must update the information contained in the pre-space notification.

(3) A post-space station notification is required no later than 3 months after termination of the space station transmissions. When termination of transmissions is ordered by the FCC, the notification is required no later than 24 hours after termination of transmissions.


§ 97.209: Earth station.

(a) Any amateur station may be an Earth station. A holder of any class operator license may be the control operator of an Earth station, subject to the privileges of the class of operator license held by the control operator.

(b) The following frequency bands and segments are authorized to Earth stations:

(1) The 17 m, 15 m, 12 m, and 10 m bands, 6 mm, 4 mm, 2 mm and 1 mm bands; and
(2) The 7.0–7.1 MHz, 14.00–14.25 MHz, 144–146 MHz, 435–438 MHz, 1260–1270 MHz and 2400–2450 MHz, 3.40–3.41 GHz, 5.65–5.67 GHz, 10.45–10.50 GHz and 24.00–24.05 GHz segments.

[54 FR 25857, June 20, 1989, as amended at 54 FR 39535, Sept. 27, 1989]

§ 97.211: Space telecommand station.

(a) Any amateur station designated by the licensee of a space station is eligible to transmit as a telecommand station for that space station, subject to the privileges of the class of operator license held by the control operator.

(b) A telecommand station may transmit special codes intended to obscure the meaning of telecommand messages to the station in space operation.

(c) The following frequency bands and segments are authorized to telecommand stations:

(1) The 17 m, 15 m, 12 m and 10 m bands, 6 mm, 4 mm, 2 mm and 1 mm bands; and
(2) The 7.0–7.1 MHz, 14.00–14.25 MHz, 144–146 MHz, 435–438 MHz, 1260–1270 MHz and 2400–2450 MHz, 3.40–3.41 GHz, 5.65–5.67 GHz, 10.45–10.50 GHz and 24.00–24.05 GHz segments.

(d) A telecommand station may transmit one-way communications.
§ 97.213: Telecommand of an amateur station.

An amateur station on or within 50 km of the Earth's surface may be under telecommand where:
(a) There is a radio or wireline control link between the control point and the station sufficient for the control operator to perform his/her duties. If radio, the control link must use an auxiliary station. A control link using a fiber optic cable or another telecommunication service is considered wireline.
(b) Provisions are incorporated to limit transmission by the station to a period of no more than 3 minutes in the event of malfunction in the control link.
(c) The station is protected against making, willfully or negligently, unauthorized transmissions.
(d) A photocopy of the station license and a label with the name, address, and telephone number of the station licensee and at least one designated control operator is posted in a conspicuous place at the station location.

§ 97.215: Telecommand of model craft.

An amateur station transmitting signals to control a model craft may be operated as follows:
(a) The station identification procedure is not required for transmissions directed only to the model craft, provided that a label indicating the station call sign and the station licensee's name and address is affixed to the station transmitter.
(b) The control signals are not considered codes or ciphers intended to obscure the meaning of the communication.
(c) The transmitter power must not exceed 1 W.

§ 97.217: Telemetry.

Telemetry transmitted by an amateur station on or within 50 km of the Earth's surface is not considered to be codes or ciphers intended to obscure the meaning of communications.

§ 97.219: Message forwarding system.

(a) Any amateur station may participate in a message forwarding system, subject to the privileges of the class of operator license held.
(b) For stations participating in a message forwarding system, the control operator of the station originating a message is primarily accountable for any violation of the rules in this part contained in the message.

(c) Except as noted in (d) of this section, for stations participating in a message forwarding system, the control operators of forwarding stations that retransmit inadvertently communications that violate the rules in this part are not accountable for the violative communications. They are, however, responsible for discontinuing such communications once they become aware of their presence.

(d) For stations participating in a message forwarding system, the control operator of the first forwarding station must:

1. Authenticate the identity of the station from which it accepts communications on behalf of the system; or
2. Accept accountability for any violation of the rules in this part contained in messages it retransmits to the system.

[59 FR 18975, Apr. 21, 1994]

§ 97.221: Automatically controlled digital station.

(a) This rule section does not apply to an auxiliary station, a beacon station, a repeater station, an earth station, a space station, or a space telecommand station.

(b) A station may be automatically controlled while transmitting a RTTY or data emission on the 6 m or shorter wavelength bands, and on the 28.120–28.189 MHz, 24.925–24.930 MHz, 21.090–21.100 MHz, 18.105–18.110 MHz, 14.0950–14.0995 MHz, 14.1005–14.112 MHz, 10.140–10.150 MHz, 7.100–7.105 MHz, or 3.585–3.600 MHz segments.

(c) A station may be automatically controlled while transmitting a RTTY or data emission on any other frequency authorized for such emission types provided that:

1. The station is responding to interrogation by a station under local or remote control; and
2. No transmission from the automatically controlled station occupies a bandwidth of more than 500 Hz.

[60 FR 26001, May 16, 1995, as amended at 72 FR 3082, Jan. 24, 2007]
§ 97.301: Authorized frequency bands.

The following transmitting frequency bands are available to an amateur station located within 50 km of the Earth's surface, within the specified ITU Region, and outside any area where the amateur service is regulated by any authority other than the FCC.

(a) For a station having a control operator who has been granted a Technician, Technician Plus, General, Advanced, or Amateur Extra Class operator license, who holds a CEPT radio amateur license, or who holds any class of IARP:

<table>
<thead>
<tr>
<th>Wavelength band</th>
<th>ITU—Region 1</th>
<th>ITU—Region 2</th>
<th>ITU—Region 3</th>
<th>Sharing requirements see §97.303 (Paragraph)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VHF</strong></td>
<td>MHz</td>
<td>MHz</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>6 m</td>
<td>50-54</td>
<td>50-54</td>
<td>(a)</td>
<td></td>
</tr>
<tr>
<td>2 m</td>
<td>144-146</td>
<td>144-148</td>
<td>144-148</td>
<td>(a)</td>
</tr>
<tr>
<td>1.25 m</td>
<td>219-220</td>
<td>(a), (e)</td>
<td>(a)</td>
<td></td>
</tr>
<tr>
<td>Do</td>
<td>222-225</td>
<td>(a)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UHF</strong></td>
<td>MHz</td>
<td>MHz</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>70 m</td>
<td>430-440</td>
<td>420-450</td>
<td>420-450</td>
<td>(a), (b), (f)</td>
</tr>
<tr>
<td>33 m</td>
<td>902-925</td>
<td>(a), (b), (g)</td>
<td>(a)</td>
<td></td>
</tr>
<tr>
<td>23 m</td>
<td>1240-1300</td>
<td>1240-1300</td>
<td>1240-12300</td>
<td>(b), (h), (i)</td>
</tr>
<tr>
<td>13 m</td>
<td>2300-2310</td>
<td>2300-2310</td>
<td>2300-2310</td>
<td>(a), (b), (j)</td>
</tr>
<tr>
<td>Do</td>
<td>2390-2450</td>
<td>2390-2450</td>
<td>2390-2450</td>
<td>(a), (b), (j)</td>
</tr>
<tr>
<td><strong>SHF</strong></td>
<td>GHz</td>
<td>GHz</td>
<td>GHz</td>
<td></td>
</tr>
<tr>
<td>9 cm</td>
<td>3.4-3.475</td>
<td>3.3-3.5</td>
<td>3.3-3.5</td>
<td>(a), (b), (k), (l)</td>
</tr>
<tr>
<td>Wavelength band</td>
<td>ITU—Region 1</td>
<td>ITU—Region 2</td>
<td>ITU—Region 3</td>
<td>Sharing requirements see §97.303 (Paragraph)</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------</td>
<td>--------------</td>
<td>--------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>5 CM</td>
<td>5.650-5.850</td>
<td>5.650-5.925</td>
<td>5.650-5.850</td>
<td>(a), (b), (m)</td>
</tr>
<tr>
<td>3 cm</td>
<td>10.00-10.50</td>
<td>10.00-10.50</td>
<td>10.00-10.50</td>
<td>(a), (c), (i), (n)</td>
</tr>
<tr>
<td>1.2 cm</td>
<td>24.00-24.25</td>
<td>24.00-24.25</td>
<td>24.00-24.25</td>
<td>(a), (b), (i), (o)</td>
</tr>
<tr>
<td><strong>EHF</strong></td>
<td>GHz</td>
<td>GHz</td>
<td>GHz</td>
<td></td>
</tr>
<tr>
<td>6 mm</td>
<td>47.0-47.2</td>
<td>47.0-47.2</td>
<td>47.0-47.2</td>
<td></td>
</tr>
<tr>
<td>4 mm</td>
<td>76-81</td>
<td>76-81</td>
<td>76-81</td>
<td>(b), (c), (h), (k), (r)</td>
</tr>
<tr>
<td>2.5 mm</td>
<td>122.25-123</td>
<td>122.25-123</td>
<td>122.25-123</td>
<td>(p)</td>
</tr>
<tr>
<td>2 mm</td>
<td>134-141</td>
<td>134-141</td>
<td>134-141</td>
<td>(b), (c), (h), (k)</td>
</tr>
<tr>
<td>1 mm</td>
<td>241-250</td>
<td>241-250</td>
<td>241-250</td>
<td>(b), (c), (h), (k), (q)</td>
</tr>
<tr>
<td>above 275</td>
<td>above 275</td>
<td>above 275</td>
<td>above 275</td>
<td>(k)</td>
</tr>
</tbody>
</table>

(b) For a station having a control operator who has been granted an Amateur Extra Class operator license, who holds a CEPT radio amateur license, or who holds a Class 1 IARP license:

<table>
<thead>
<tr>
<th>Wavelength band</th>
<th>ITU—Region 1</th>
<th>ITU—Region 2</th>
<th>ITU—Region 3</th>
<th>Sharing requirements see §97.303 (Paragraph)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MF</strong></td>
<td>kHz</td>
<td>kHz</td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td>160 m</td>
<td>1810-1850</td>
<td>1800-2000</td>
<td>1800-2000</td>
<td>(a), (b), (c)</td>
</tr>
<tr>
<td>Wavelength band</td>
<td>ITU—Region 1</td>
<td>ITU—Region 2</td>
<td>ITU—Region 3</td>
<td>Sharing requirements see §97.303 (Paragraph)</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------</td>
<td>--------------</td>
<td>--------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td><strong>HF</strong></td>
<td>MHz</td>
<td>MHz</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>80 m</td>
<td>3.50-3.60</td>
<td>3.50-3.60</td>
<td>3.50-3.60</td>
<td>(a)</td>
</tr>
<tr>
<td>75 m</td>
<td>3.60-3.80</td>
<td>3.60-4.00</td>
<td>3.60-3.90</td>
<td>(a)</td>
</tr>
<tr>
<td>40 m</td>
<td>7.0-7.2</td>
<td>7.0-7.3</td>
<td>7.0-7.2</td>
<td>(a), (t)</td>
</tr>
<tr>
<td>30 m</td>
<td>10.10-10.15</td>
<td>10.10-10.15</td>
<td>10.10-10.15</td>
<td>(d)</td>
</tr>
<tr>
<td>20 m</td>
<td>14.00-14.35</td>
<td>14.00-14.35</td>
<td>14.00-14.35</td>
<td></td>
</tr>
<tr>
<td>17 m</td>
<td>18.068-18.168</td>
<td>18.068-18.168</td>
<td>18.068-18.168</td>
<td></td>
</tr>
<tr>
<td>15 m</td>
<td>21.00-21.45</td>
<td>21.00-21.45</td>
<td>21.00-21.45</td>
<td></td>
</tr>
<tr>
<td>10 m</td>
<td>28.0-29.7</td>
<td>28.0-29.7</td>
<td>28.0-29.7</td>
<td></td>
</tr>
</tbody>
</table>

(c) For a station having a control operator who has been granted an operator license of Advanced Class:

<table>
<thead>
<tr>
<th>Wavelength band</th>
<th>ITU—Region 1</th>
<th>ITU—Region 2</th>
<th>ITU—Region 3</th>
<th>Sharing requirements see §97.303 (Paragraph)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MF</strong></td>
<td>kHz</td>
<td>kHz</td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td>160 m</td>
<td>1810-1850</td>
<td>1800-2000</td>
<td>1800-2000</td>
<td>(a), (b), (c)</td>
</tr>
<tr>
<td><strong>HF</strong></td>
<td>MHz</td>
<td>MHz</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>Wavelength band</td>
<td>ITU—Region 1</td>
<td>ITU—Region 2</td>
<td>ITU—Region 3</td>
<td>Sharing requirements see §97.303 (Paragraph)</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>80 m</td>
<td>3.525-3.60</td>
<td>3.525-3.60</td>
<td>3.525-3.60</td>
<td>(a)</td>
</tr>
<tr>
<td>75 m</td>
<td>3.70-3.80</td>
<td>3.70-4.00</td>
<td>3.700-3.90</td>
<td>(a)</td>
</tr>
<tr>
<td>40 m</td>
<td>7.025-7.200</td>
<td>7.025-7.300</td>
<td>7.025-7.200</td>
<td>(a), (t)</td>
</tr>
<tr>
<td>30 m</td>
<td>10.10-10.15</td>
<td>10.10-10.15</td>
<td>10.10-10.15</td>
<td>(d)</td>
</tr>
<tr>
<td>17 m</td>
<td>18.068-18.168</td>
<td>18.068-18.168</td>
<td>18.068-18.168</td>
<td></td>
</tr>
<tr>
<td>10 m</td>
<td>28.0-29.7</td>
<td>28.0-29.7</td>
<td>28.0-29.7</td>
<td></td>
</tr>
</tbody>
</table>

(d) For a station having a control operator who has been granted an operator license of General Class:

<table>
<thead>
<tr>
<th>Wavelength band</th>
<th>ITU—Region 1</th>
<th>ITU—Region 2</th>
<th>ITU—Region 3</th>
<th>Sharing requirements see §97.303 (Paragraph)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MF</strong></td>
<td>kHz</td>
<td>kHz</td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td>160 m</td>
<td>1810-1850</td>
<td>1800-2000</td>
<td>1800-2000</td>
<td>(a), (b), (c)</td>
</tr>
</tbody>
</table>
Wavelength band | ITU—Region 1 | ITU—Region 2 | ITU—Region 3 | Sharing requirements see §97.303 (Paragraph)
---|---|---|---|---
HF | MHz | MHz | MHz |
80 m | 3.525-3.60 | 3.525-3.60 | 3.525-3.60 | (a)
75 m | 3.80-4.00 | 3.80-3.90 | | (a)
40 m | 7.025-7.125 | 7.025-7.125 | 7.025-7.125 | (a)
Do | 7.175-7.300 | | | (a)
30 m | 10.10-10.15 | 10.10-10.15 | 10.10-10.15 | (d)
17 m | 18.068-18.168 | 18.068-18.168 | 18.068-18.168 | |
10 m | 28.0-29.7 | 28.0-29.7 | 28.0-29.7 | |
(e) For a station having a control operator who has been granted an operator license of Novice Class, Technician Class, or Technician Plus Class:
<table>
<thead>
<tr>
<th>Wavelength band</th>
<th>ITU—Region 1</th>
<th>ITU—Region 2</th>
<th>ITU—Region 3</th>
<th>Sharing requirements see §97.303 (Paragraph)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HF</strong></td>
<td>MHz</td>
<td>MHz</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>80 m</td>
<td>3.525-3.60</td>
<td>3.525-3.60</td>
<td>3.525-3.60</td>
<td>(a)</td>
</tr>
<tr>
<td>40 m</td>
<td>7.025-7.075</td>
<td>7.025-7.100</td>
<td>7.025-7.075</td>
<td></td>
</tr>
<tr>
<td>Do</td>
<td>7.100-7.125</td>
<td>7.100-7.125</td>
<td>7.100-7.125</td>
<td>(a), (t)</td>
</tr>
<tr>
<td>10 m</td>
<td>28.0-28.5</td>
<td>28.0-28.5</td>
<td>28.0-28.5</td>
<td></td>
</tr>
<tr>
<td><strong>VHF</strong></td>
<td>MHz</td>
<td>MHz</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>1.25 m</td>
<td>222-225</td>
<td></td>
<td></td>
<td>(a)</td>
</tr>
<tr>
<td><strong>UHF</strong></td>
<td>MHz</td>
<td>MHz</td>
<td>MHz</td>
<td></td>
</tr>
<tr>
<td>23 m</td>
<td>1270-1295</td>
<td>1270-1295</td>
<td>1270-1295</td>
<td>(h), (i)</td>
</tr>
</tbody>
</table>

Editorial Note: For Federal Register citations affecting §97.301, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and on GPO Access.

§ 97.303: Frequency sharing requirements.

The following is a summary of the frequency sharing requirements that apply to amateur station transmissions on the frequency bands specified in §97.301 of this part. (For each ITU Region, each frequency band allocated to the amateur service is designated as either a secondary service or a primary service. A station in a secondary service must not cause harmful interference to, and must accept interference from, stations in a primary service. See §§2.105 and 2.106 of the FCC Rules, United States Table of Frequency Allocations for complete requirements.)

(a) Where, in adjacent ITU Regions or sub-Regions, a band of frequencies is allocated to different services of the same category (i.e., primary or secondary allocations), the basic principle is the equality of right to operate. Accordingly, stations of each service in one Region or sub-Region must operate so as not to cause harmful interference to any service of the same or
higher category in the other Regions or sub-Regions. (See ITU Radio Regulations, edition of 2004, No. 4.8.)

(b) No amateur station transmitting in the 1900–2000 kHz segment, the 70 cm band, the 33 cm band, the 23 cm band, the 13 cm band, the 9 cm band, the 5 cm band, the 3 cm band, the 24.05–24.25 GHz segment, the 76–77.5 GHz segment, the 78–81 GHz segment, the 136–141 GHz segment, and the 241–248 GHz segment shall cause harmful interference to, nor is protected from interference due to the operation of, the Federal radiolocation service.

(c) No amateur station transmitting in the 1900–2000 kHz segment, the 3 cm band, the 76–77.5 GHz segment, the 78–81 GHz segment, the 136–141 GHz segment, and the 241–248 GHz segment shall cause harmful interference to, nor is protected from interference due to the operation of, stations in the non-Federal radiolocation service.

(d) No amateur station transmitting in the 30 meter band shall cause harmful interference to stations authorized by other nations in the fixed service. The licensee of the amateur station must make all necessary adjustments, including termination of transmissions, if harmful interference is caused.

(e) In the 1.25 m band:

(1) Use of the 219–220 MHz segment is limited to amateur stations participating, as forwarding stations, in point-to-point fixed digital message forwarding systems, including intercity packet backbone networks. It is not available for other purposes.

(2) No amateur station transmitting in the 219–220 MHz segment shall cause harmful interference to, nor is protected from interference due to operation of Automated Maritime Telecommunications Systems (AMTS), television broadcasting on channels 11 and 13, 218–219 MHz Service systems, Land Mobile Services systems, or any other service having a primary allocation in or adjacent to the band.

(3) No amateur station may transmit in the 219–220 MHz segment unless the licensee has given written notification of the station's specific geographic location for such transmissions in order to be incorporated into a data base that has been made available to the public. The notification must be given at least 30 days prior to making such transmissions. The notification must be given to: The American Radio Relay, Inc., 225 Main Street, Newington, CT 06111–1494.

(4) No amateur station may transmit in the 219–220 MHz segment from a location that is within 640 km of an AMTS Coast Station that uses frequencies in the 217–218/219–220 MHz AMTS bands unless the amateur station licensee has given written notification of the station's specific geographic location for such transmissions to the AMTS licensee. The notification must be given at least 30 days prior to making such transmissions. The location of AMTS Coast Stations using the 217–218/219–220 MHz channels may be obtained from either:

The American Radio Relay League, Inc., 225 Main Street, Newington, CT 06111–1494;

or

Interactive Systems, Inc., Suite 1103, 1601 North Kent Street, Arlington, VA 22209; Fax: (703) 812–8275; Phone: (703) 812–8270.
(5) No amateur station may transmit in the 219–220 MHz segment from a location that is within 80 km of an AMTS Coast Station that uses frequencies in the 217–218/219–220 MHz AMTS bands unless that amateur station licensee holds written approval from that AMTS licensee. The location of AMTS Coast Stations using the 217–218/219–220 MHz channels may be obtained as noted in paragraph (e)(4) of this section.

(f) In the 70 cm band:

(1) No amateur station shall transmit from north of Line A in the 420–430 MHz segment.

(2) The 420–430 MHz segment is allocated to the amateur service in the United States on a secondary basis, and is allocated in the fixed and mobile (except aeronautical mobile) services in the International Table of allocations on a primary basis. No amateur station transmitting in this band shall cause harmful interference to, nor is protected from interference due to the operation of, stations authorized by other nations in the fixed and mobile (except aeronautical mobile) services.

(3) The 430–440 MHz segment is allocated to the amateur service on a secondary basis in ITU Regions 2 and 3. No amateur station transmitting in this band in ITU Regions 2 and 3 shall cause harmful interference to, nor is protected from interference due to the operation of, stations authorized by other nations in the radiolocation service. In ITU Region 1, the 430–440 MHz segment is allocated to the amateur service on a co-primary basis with the radiolocation service. As between these two services in this band in ITU Region 1, the basic principle that applies is the equality of right to operate. Amateur stations authorized by the United States and radiolocation stations authorized by other nations in ITU Region 1 shall operate so as not to cause harmful interference to each other.

(4) No amateur station transmitting in the 449.75–450.00 MHz segment shall cause interference to, nor is protected from interference due to the operation of stations in, the space operation and space research services.

(g) In the 33 cm band:

(1) In the States of Colorado and Wyoming, bounded by the area of latitude 396° N. to 42° N. and longitude 103° W. to 108° W., an amateur station may transmit in the 902 MHz to 928 MHz band only on the frequency segments 902.0–902.4, 902.6–904.3, 904.7–925.3, 925.7–927.3, and 927.7–928.0 MHz. This band is allocated on a secondary basis to the amateur service subject to not causing harmful interference to, and not receiving any interference protection from, the operation of industrial, scientific and medical devices, automatic vehicle monitoring systems, or Government stations authorized in this band.

(2) No amateur station shall transmit from those portions of the States of Texas and New Mexico bounded on the south by latitude 31°41’ N., on the north by latitude 34°30’ N., on the east by longitude 104°11’ W., and on the west by longitude 107°30’ W.

(h) No amateur station transmitting in the 23 cm band, the 3.3–3.4 GHz segment, the 3 cm band, the 24.05–24.25 GHz segment, the 76–77.5 GHz segment, the 78–81 GHz segment, the 136–141 GHz segment, and the 241–248 GHz segment shall cause harmful interference to, nor is
protected from interference due to the operation of, stations authorized by other nations in the radiolocation service.

(i) In the 23 cm band, no amateur station shall cause harmful interference to, nor is protected from interference due to the operation of, stations in the radionavigation-satellite service, the aeronautical radionavigation service, the Earth exploration-satellite service (active), or the space research service (active).

(j) In the 13 cm band:

(1) The amateur service is allocated on a secondary basis in all ITU Regions. In ITU Region 1, no amateur station shall cause harmful interference to, and shall not be protected from interference due to the operation of, stations authorized by other nations in the fixed and mobile services. In ITU Regions 2 and 3, no amateur station shall cause harmful interference to, and shall not be protected from interference due to the operation of, stations authorized by other nations in the fixed, mobile and radiolocation services.

(2) In the United States:

(i) The 2300–2305 MHz segment is allocated to the amateur service on a secondary basis. (Currently the 2300–2305 MHz segment is not allocated to any service on a primary basis.);

(ii) The 2305–2310 MHz segment is allocated to the amateur service on a secondary basis to the fixed, mobile, and radiolocation services;

(iii) The 2390–2417 MHz segment is allocated to the amateur service on a primary basis.


(B) Amateur stations operating in the 2400–2417 MHz segment must accept harmful interference that may be caused by the proper operation of industrial, scientific and medical equipment.

(iv) The 2417–2450 MHz segment is allocated to the amateur service on a co-secondary basis with the Federal Government radiolocation service. Amateur stations operating within the 2417–2450 MHz segment must accept harmful interference that may be caused by the proper operation of industrial, scientific, and medical devices operating within the band.


(l) In the 9 cm band:
(1) In ITU Regions 2 and 3, the 9 cm band is allocated to the amateur service on a secondary basis. In ITU Region 1, the segment 3.4–3.475 GHz is allocated to the amateur service on a secondary basis for use only in Germany, Israel, and the United Kingdom.

(2) In the United States, the 9 cm band is allocated to the amateur and non-Federal radiolocation services on a secondary basis.

(3) In the 3.4–3.5 GHz segment, no amateur station shall cause harmful interference to, nor is protected from interference due to the operation of, stations in the fixed and fixed-satellite services.

(4) In the 3.4–3.5 GHz segment, no amateur station shall cause harmful interference to, nor is protected from interference due to the operation of, stations authorized by other nations in the fixed and fixed-satellite service.

(m) In the 5 cm band:

(1) In the 5.650–5.725 GHz segment, the amateur service is allocated in all ITU Regions on a co-secondary basis with the space research (deep space) service.

(2) In the 5.725–5.850 GHz segment, the amateur service is allocated in all ITU Regions on a secondary basis. No amateur station shall cause harmful interference to, nor is protected from interference due to the operation of, stations authorized by other nations in the fixed-satellite service in ITU Region 1.

(3) No amateur station transmitting in the 5.725–5.875 GHz segment is protected from interference due to the operation of industrial, scientific and medical devices operating on 5.8 GHz.

(4) In the 5.650–5.850 GHz segment, no amateur station shall cause harmful interference to, nor is protected from interference due to the operation of, stations authorized by other nations in the radiolocation service.

(5) In the 5.850–5.925 GHz segment, the amateur service is allocated in ITU Region 2 on a co-secondary basis with the radiolocation service. In the United States, the segment is allocated to the amateur service on a secondary basis to the non-Government fixed-satellite service. No amateur station shall cause harmful interference to, nor is protected from interference due to the operation of, stations authorized by other nations in the fixed, fixed-satellite and mobile services. No amateur station shall cause harmful interference to, nor is protected from interference due to the operation of, stations in the non-Government fixed-satellite service.

(n) In the 3 cm band:

(1) In the United States, the 3 cm band is allocated to the amateur service on a co-secondary basis with the non-government radiolocation service.

(2) In the 10.00–10.45 GHz segment in ITU Regions 1 and 3, no amateur station shall cause interference to, nor is protected from interference due to the operation of, stations authorized by other nations in the fixed and mobile services.

(o) No amateur station transmitting in the 1.2 cm band is protected from interference due to the operation of industrial, scientific and medical devices on 24.125 GHz. In the United States, the 24.05–24.25 GHz segment is allocated to the amateur service on a co-secondary basis with the
non-government radiolocation and Government and non-government Earth exploration-satellite (active) services.

(p) The 2.5 mm band is allocated to the amateur service on a secondary basis. No amateur station transmitting in this band shall cause harmful interference to, nor is protected from interference due to the operation of, stations in the fixed, inter-satellite and mobile services.

(q) No amateur station transmitting in the 244–246 GHz segment of the 1 mm band is protected from interference due to the operation of industrial, scientific and medical devices on 245 GHz.

(r) Authorization of the 76–77 GHz segment of the 4 mm band for amateur station transmissions is suspended until such time that the Commission may determine that amateur station transmissions in this segment will not pose a safety threat to vehicle radar systems operating in this segment.

(s) An amateur station having an operator holding a General, Advanced or Amateur Extra Class license may only transmit single sideband, suppressed carrier, (emission type 2K8J3E) upper sideband on the channels 5332 kHz, 5348 kHz, 5368 kHz, 5373 kHz, and 5405 kHz. Amateur operators shall ensure that their transmission occupies only the 2.8 kHz centered around each of these frequencies. Transmissions shall not exceed an effective radiated power (e.r.p) of 50 W PEP. For the purpose of computing e.r.p. the transmitter PEP will be multiplied with the antenna gain relative to a dipole or the equivalent calculation in decibels. A half wave dipole antenna will be presumed to have a gain of 0 dBi. Licensees using other antennas must maintain in their station records either manufacturer data on the antenna gain or calculations of the antenna gain. No amateur station shall cause harmful interference to stations authorized in the mobile and fixed services; nor is any amateur station protected from interference due to the operation of any such station.

(t)(1) The 7–7.1 MHz segment is allocated to the amateur and amateur-satellite services on a primary and exclusive basis throughout the world, except that the 7–7.05 MHz segment is:

   (i) Additionally allocated to the fixed service on a primary basis in the countries listed in 47 CFR 2.106, footnote 5.140; and

   (ii) Alternatively allocated to the fixed service on a primary and exclusive basis (i.e., the segment 7–7.05 MHz is not allocated to the amateur service) in the countries listed in 47 CFR 2.106, footnote 5.141.

(2) The 7.1–7.2 MHz segment is allocated to the amateur service on an exclusive basis in Region 2. Until March 29, 2009, the 7.1–7.2 MHz segment is allocated to the amateur and broadcasting services on a co-primary basis in Region 1 and Region 3 and the use of the 7.1–7.2 MHz segment by the amateur service shall not impose constraints on the broadcasting service intended for use within Region 1 and Region 3. After March 29, 2009, the 7.1–7.2 MHz segment is allocated to the amateur service on a primary and exclusive basis throughout the world, except that the 7.1–7.2 MHz segment is additionally allocated to the fixed and mobile except aeronautical mobile (R) services on a primary basis in the countries listed in 47 CFR 2.106, footnote 5.141B.

(3) The 7.2–7.3 MHz segment is allocated to the amateur service on an exclusive basis in Region 2 and to the broadcasting service on an exclusive basis in Region 1 and Region 3. The use of the 7.2–7.3 MHz segment in Region 2 by the amateur service shall not impose constraints on the broadcasting service intended for use within Region 1 and Region 3.
§ 97.305: Authorized emission types.

(a) Except as specified elsewhere in this part, an amateur station may transmit a CW emission on any frequency authorized to the control operator.

(b) A station may transmit a test emission on any frequency authorized to the control operator for brief periods for experimental purposes, except that no pulse modulation emission may be transmitted on any frequency where pulse is not specifically authorized and no SS modulation emission may be transmitted on any frequency where SS is not specifically authorized.

(c) A station may transmit the following emission types on the frequencies indicated, as authorized to the control operator, subject to the standards specified in §97.307(f) of this part:

<table>
<thead>
<tr>
<th>Wavelength band</th>
<th>Frequencies</th>
<th>Emission types authorized</th>
<th>Standards see §97.307(f), paragraph:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>160 m</td>
<td>Entire Band</td>
<td>RTTY, data</td>
<td>(3).</td>
</tr>
<tr>
<td>160 m</td>
<td>Entire Band</td>
<td>Phone, image</td>
<td>(1), (2).</td>
</tr>
<tr>
<td>HF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80 m</td>
<td>Entire Band</td>
<td>RTTY, data</td>
<td>(3), (9)</td>
</tr>
<tr>
<td>75 M</td>
<td>Entire Band</td>
<td>Entire Band</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>40 m</td>
<td>7.000-7.100 MHz</td>
<td>RTTY, data</td>
<td>(3), (9)</td>
</tr>
<tr>
<td>40 m</td>
<td>7.075-7.100 MHz</td>
<td>Phone, image</td>
<td>(1), (2), (9), (11)</td>
</tr>
<tr>
<td>40 m</td>
<td>7.100-7.125 MHz</td>
<td>RTTY, data</td>
<td>(3), (9)</td>
</tr>
<tr>
<td>Wavelength band</td>
<td>Frequencies</td>
<td>Emission types authorized</td>
<td>Standards see §97.307(f), paragraph:</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td>---------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>40 m</td>
<td>7.125-7.300 MHz</td>
<td>Phone, image</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>30 m</td>
<td>Entire band</td>
<td>RTTY, data</td>
<td>(3)</td>
</tr>
<tr>
<td>20 cm</td>
<td>Entire band</td>
<td>RTTY, data</td>
<td>(3)</td>
</tr>
<tr>
<td>20 m</td>
<td>14.00-14.15 MHz</td>
<td>RTTY, data</td>
<td>(3)</td>
</tr>
<tr>
<td>20 m</td>
<td>14.15-14.35 MHz</td>
<td>Phone, image</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>17 m</td>
<td>18.068-18.110 MHz</td>
<td>RTTY, data</td>
<td>(3)</td>
</tr>
<tr>
<td>17 m</td>
<td>18.110-18.168 MHz</td>
<td>Phone, image</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>15 m</td>
<td>21.0–21.2 MHz</td>
<td>RTTY, data</td>
<td>(3), (9)</td>
</tr>
<tr>
<td>15 m</td>
<td>21.20–21.45 MHz</td>
<td>Phone, image</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>12 M</td>
<td>24.89–24.93 MHz</td>
<td>RTTY, data</td>
<td>(3)</td>
</tr>
<tr>
<td>12 m</td>
<td>24.93–24.99 MHz</td>
<td>Phone, image</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>10 M</td>
<td>28.0–28.3 MHz</td>
<td>RTTY, data</td>
<td>(4)</td>
</tr>
<tr>
<td>10 m</td>
<td>28.3–28.5 MHz</td>
<td>Phone, image</td>
<td>(1), (2), (10)</td>
</tr>
<tr>
<td>10 m</td>
<td>28.5–29.0 MHz</td>
<td>Phone, image</td>
<td>(1), (2)</td>
</tr>
<tr>
<td>10 m</td>
<td>29.0–29.7 MHz</td>
<td>Phone, image</td>
<td>(2)</td>
</tr>
<tr>
<td>Wavelength band</td>
<td>Frequencies</td>
<td>Emission types authorized</td>
<td>Standards see §97.307(f), paragraph:</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------</td>
<td>-----------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td><strong>VHF</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 m</td>
<td>50.1–51.0 MHz</td>
<td>MCW, phone, image, RTTY, data</td>
<td>(2), (5).</td>
</tr>
<tr>
<td>Do</td>
<td>51.0–54.0 MHz</td>
<td>MCW, phone, image, RTTY, data, test</td>
<td>(2), (5), (8).</td>
</tr>
<tr>
<td>2 m</td>
<td>144.1–148.0 MHz</td>
<td>MCW, phone, image, RTTY, data, test</td>
<td>(2), (5), (8).</td>
</tr>
<tr>
<td>125 M</td>
<td>219–220 MHz</td>
<td>Data</td>
<td>(13)</td>
</tr>
<tr>
<td>Do</td>
<td>222–225 MHz</td>
<td>RTTY, data, test MCW, phone, SS, image</td>
<td>(2), (6), (8)</td>
</tr>
<tr>
<td><strong>UHF</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 cm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test</td>
<td>(6), (8)</td>
</tr>
<tr>
<td>33 cm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>23 cm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>13 cm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td><strong>SHF</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wavelength band</td>
<td>Frequencies</td>
<td>Emission types authorized</td>
<td>Standards see §97.307(f), paragraph:</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
<td>---------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>9 cm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>5 cm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>3 cm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>1.2 cm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td><strong>EHF</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 mm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>4 mm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>2.5 mm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>2 mm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>1 mm</td>
<td>Entire band</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
<tr>
<td>Wavelength band</td>
<td>Frequencies</td>
<td>Emission types authorized</td>
<td>Standards see §97.307(f), paragraph:</td>
</tr>
<tr>
<td>-----------------</td>
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<td>-------------------------------------</td>
</tr>
<tr>
<td>---</td>
<td>Above 300 GHz</td>
<td>MCW, phone, image, RTTY, data, SS, test, pulse</td>
<td>(7), (8), and (12).</td>
</tr>
</tbody>
</table>


§ 97.307: Emission standards.

(a) No amateur station transmission shall occupy more bandwidth than necessary for the information rate and emission type being transmitted, in accordance with good amateur practice.

(b) Emissions resulting from modulation must be confined to the band or segment available to the control operator. Emissions outside the necessary bandwidth must not cause splatter or keyclick interference to operations on adjacent frequencies.

(c) All spurious emissions from a station transmitter must be reduced to the greatest extent practicable. If any spurious emission, including chassis or power line radiation, causes harmful interference to the reception of another radio station, the licensee of the interfering amateur station is required to take steps to eliminate the interference, in accordance with good engineering practice.

(d) For transmitters installed after January 1, 2003, the mean power of any spurious emission from a station transmitter or external RF power amplifier transmitting on a frequency below 30 MHz must be at least 43 dB below the mean power of the fundamental emission. For transmitters installed on or before January 1, 2003, the mean power of any spurious emission from a station transmitter or external RF power amplifier transmitting on a frequency below 30 MHz must not exceed 50 mW and must be at least 40 dB below the mean power of the fundamental emission. For a transmitter of mean power less than 5 W installed on or before January 1, 2003, the attenuation must be at least 30 dB. A transmitter built before April 15, 1977, or first marketed before January 1, 1978, is exempt from this requirement.

(e) The mean power of any spurious emission from a station transmitter or external RF power amplifier transmitting on a frequency between 30–225 MHz must be at least 60 dB below the mean power of the fundamental. For a transmitter having a mean power of 25 W or less, the mean power of any spurious emission supplied to the antenna transmission line must not exceed 25 µW and must be at least 40 dB below the mean power of the fundamental emission, but need not be reduced below the power of 10 µW. A transmitter built before April 15, 1977, or first marketed before January 1, 1978, is exempt from this requirement.

(f) The following standards and limitations apply to transmissions on the frequencies specified in §97.305(c) of this part.
(1) No angle-modulated emission may have a modulation index greater than 1 at the highest modulation frequency.

(2) No non-phone emission shall exceed the bandwidth of a communications quality phone emission of the same modulation type. The total bandwidth of an independent sideband emission (having B as the first symbol), or a multiplexed image and phone emission, shall not exceed that of a communications quality A3E emission.

(3) Only a RTTY or data emission using a specified digital code listed in §97.309(a) of this part may be transmitted. The symbol rate must not exceed 300 bauds, or for frequency-shift keying, the frequency shift between mark and space must not exceed 1 kHz.

(4) Only a RTTY or data emission using a specified digital code listed in §97.309(a) of this part may be transmitted. The symbol rate must not exceed 1200 bauds, or for frequency-shift keying, the frequency shift between mark and space must not exceed 1 kHz.

(5) A RTTY, data or multiplexed emission using a specified digital code listed in §97.309(a) of this part may be transmitted. The symbol rate must not exceed 19.6 kilobauds. A RTTY, data or multiplexed emission using an unspecified digital code under the limitations listed in §97.309(b) of this part also may be transmitted. The authorized bandwidth is 20 kHz.

(6) A RTTY, data or multiplexed emission using a specified digital code listed in §97.309(a) of this part may be transmitted. The symbol rate must not exceed 56 kilobauds. A RTTY, data or multiplexed emission using an unspecified digital code under the limitations listed in §97.309(b) of this part also may be transmitted. The authorized bandwidth is 100 kHz.

(7) A RTTY, data or multiplexed emission using a specified digital code listed in §97.309(a) of this part or an unspecified digital code under the limitations listed in §97.309(b) of this part may be transmitted.

(8) A RTTY or data emission having designators with A, B, C, D, E, F, G, H, J or R as the first symbol; 1, 2, 7 or 9 as the second symbol; and D or W as the third symbol is also authorized.

(9) A station having a control operator holding a Novice or Technician Class operator license may only transmit a CW emission using the international Morse code.

(10) A station having a control operator holding a Novice Class operator license or a Technician Class operator license and who has received credit for proficiency in telegraphy in accordance with the international requirements may only transmit a CW emission using the international Morse code or phone emissions J3E and R3E.

(11) Phone and image emissions may be transmitted only by stations located in ITU Regions 1 and 3, and by stations located within ITU Region 2 that are west of 130° West longitude or south of 20° North latitude.

(12) Emission F8E may be transmitted.

(13) A data emission using an unspecified digital code under the limitations listed in §97.309(b) also may be transmitted. The authorized bandwidth is 100 kHz.
§ 97.309: RTTY and data emission codes.

(a) Where authorized by §§97.305(c) and 97.307(f) of the part, an amateur station may transmit a RTTY or data emission using the following specified digital codes:

1. The 5-unit, start-stop, International Telegraph Alphabet No. 2, code defined in ITU–T Recommendation F.1, Division C (commonly known as “Baudot”).

2. The 7-unit code specified in ITU–R Recommendations M.476–5 and M.625–3 (commonly known as “AMTOR”).

3. The 7-unit, International Alphabet No. 5, code defined in IT–T Recommendation T.50 (commonly known as “ASCII”).

4. An amateur station transmitting a RTTY or data emission using a digital code specified in this paragraph may use any technique whose technical characteristics have been documented publicly, such as CLOVER, G-TOR, or PacTOR, for the purpose of facilitating communications.

(b) Where authorized by §§97.305(c) and 97.307(f) of this part, a station may transmit a RTTY or data emission using an unspecified digital code, except to a station in a country with which the United States does not have an agreement permitting the code to be used. RTTY and data emissions using unspecified digital codes must not be transmitted for the purpose of obscuring the meaning of any communication. When deemed necessary by a District Director to assure compliance with the FCC Rules, a station must:

1. Cease the transmission using the unspecified digital code;

2. Restrict transmissions of any digital code to the extent instructed;

3. Maintain a record, convertible to the original information, of all digital communications transmitted.

§ 97.311: SS emission types.

(a) SS emission transmissions by an amateur station are authorized only for communications between points within areas where the amateur service is regulated by the FCC and between an area where the amateur service is regulated by the FCC and an amateur station in another country that permits such communications. SS emission transmissions must not be used for the purpose of obscuring the meaning of any communication.

(b) A station transmitting SS emissions must not cause harmful interference to stations employing other authorized emissions, and must accept all interference caused by stations employing other authorized emissions.
(c) When deemed necessary by a District Director to assure compliance with this part, a station licensee must:

1. Cease SS emission transmissions;
2. Restrict SS emission transmissions to the extent instructed; and
3. Maintain a record, convertible to the original information (voice, text, image, etc.) of all spread spectrum communications transmitted.

(d) The transmitter power must not exceed 100 W under any circumstances. If more than 1 W is used, automatic transmitter control shall limit output power to that which is required for the communication. This shall be determined by the use of the ratio, measured at the receiver, of the received energy per user data bit (\(E_b\)) to the sum of the received power spectral densities of noise \((N_0)\) and co-channel interference \((I_0)\). Average transmitter power over 1 W shall be automatically adjusted to maintain an \(E_b / (N_0 + I_0)\) ratio of no more than 23 dB at the intended receiver.

[64 FR 51471, Sept. 23, 1999]

§ 97.313: Transmitter power standards.

(a) An amateur station must use the minimum transmitter power necessary to carry out the desired communications.

(b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

(c) No station may transmit with a transmitter power exceeding 200 W PEP:

1. On the 10.10–10.15 MHz segment;
2. When the control operator is a Novice Class operator or a Technician Class operator who has received credit for proficiency in telegraphy in accordance with the international requirements; or
3. The 7.050–7.075 MHz segment when the station is within ITU Regions 1 or 3.

(d) No station may transmit with a transmitter power exceeding 25 W PEP on the VHF 1.25 m band when the control operator is a Novice operator.

(e) No station may transmit with a transmitter power exceeding 5 W PEP on the UHF 23 cm band when the control operator is a Novice operator.

(f) No station may transmit with a transmitter power exceeding 50 W PEP on the UHF 70 cm band from an area specified in footnote US7 to §2.106 of part 2, unless expressly authorized by the FCC after mutual agreement, on a case-by-case basis, between the District Director of the applicable field facility and the military area frequency coordinator at the applicable military base. An Earth station or telecommand station, however, may transmit on the 435–438 MHz segment with a maximum of 611 W effective radiated power (1 kW equivalent isotropically radiated power) without the authorization otherwise required. The transmitting antenna elevation angle between the lower half-power (−3 dB relative to the peak or antenna bore sight) point and the horizon must always be greater than 10°.

(g) No station may transmit with a transmitter power exceeding 50 W PEP on the 33 cm band from within 241 km of the boundaries of the White Sands Missile Range. Its boundaries are
those portions of Texas and New Mexico bounded on the south by latitude 31°41' North, on the east by longitude 104°11' West, on the north by latitude 34°30' North, and on the west by longitude 107°30' West.

(h) No station may transmit with a transmitter power exceeding 50 W PEP on the 219–220 MHz segment of the 1.25 m band.


§ 97.315: Certification of external RF power amplifiers

(a) Any external RF power amplifier (see §2.815 of the FCC Rules) manufactured or imported for use at an amateur radio station must be certificated for use in the amateur service in accordance with subpart J of part 2 of the FCC Rules. No amplifier capable of operation below 144 MHz may be constructed or modified by a non-amateur service licensee without a grant of certification from the FCC.

(b) The requirement of paragraph (a) does not apply if one or more of the following conditions are met:

(1) The amplifier is constructed or modified by an amateur radio operator for use at an amateur station.

(2) The amplifier was manufactured before April 28, 1978, and has been issued a marketing waiver by the FCC, or the amplifier was purchased before April 28, 1978, by an amateur radio operator for use at that operator's station.

(3) The amplifier is sold to an amateur radio operator or to a dealer, the amplifier is purchased in used condition by a dealer, or the amplifier is sold to an amateur radio operator for use at that operator's station.

(c) Any external RF power amplifier appearing in the Commission's database as certificated for use in the amateur service may be marketed for use in the amateur service.

[71 FR 66465, Nov. 15, 2006]

§ 97.317: Standards for certification of external RF power amplifiers.

(a) To receive a grant of certification, the amplifier must:

(1) Satisfy the spurious emission standards of §97.307 (d) or (e) of this part, as applicable, when the amplifier is operated at the lesser of 1.5 kW PEP or its full output power and when the amplifier is placed in the “standby” or “off” positions while connected to the transmitter.

(2) Not be capable of amplifying the input RF power (driving signal) by more than 15 dB gain. Gain is defined as the ratio of the input RF power to the output RF power of the amplifier where both power measurements are expressed in peak envelope power or mean power.

(3) Exhibit no amplification (0 dB gain) between 26 MHz and 28 MHz.
(b) Certification shall be denied when:

(1) The Commission determines the amplifier can be used in services other than the Amateur Radio Service, or

(2) The amplifier can be easily modified to operate on frequencies between 26 MHz and 28 MHz.

[71 FR 66465, Nov. 15, 2006]
§ 97.401: Operation during a disaster.

A station in, or within 92.6 km (50 nautical miles) of, Alaska may transmit emissions J3E and R3E on the channel at 5.1675 MHz (assigned frequency 5.1689 MHz) for emergency communications. The channel must be shared with stations licensed in the Alaska-Private Fixed Service. The transmitter power must not exceed 150 W PEP. A station in, or within 92.6 km of, Alaska may transmit communications for tests and training drills necessary to ensure the establishment, operation, and maintenance of emergency communication systems.

[71 FR 66465, Nov. 15, 2006]

§ 97.403: Safety of life and protection of property.

No provision of these rules prevents the use by an amateur station of any means of radiocommunication at its disposal to provide essential communication needs in connection with the immediate safety of human life and immediate protection of property when normal communication systems are not available.

§ 97.405: Station in distress.

(a) No provision of these rules prevents the use by an amateur station in distress of any means at its disposal to attract attention, make known its condition and location, and obtain assistance.

(b) No provision of these rules prevents the use by a station, in the exceptional circumstances described in paragraph (a) of this section, of any means of radiocommunications at its disposal to assist a station in distress.

§ 97.407: Radio amateur civil emergency service.

(a) No station may transmit in RACES unless it is an FCC-licensed primary, club, or military recreation station and it is certified by a civil defense organization as registered with that organization, or it is an FCC-licensed RACES station. No person may be the control operator of a RACES station, or may be the control operator of an amateur station transmitting in RACES unless that person holds a FCC-issued amateur operator license and is certified by a civil defense organization as enrolled in that organization.

(b) The frequency bands and segments and emissions authorized to the control operator are available to stations transmitting communications in RACES on a shared basis with the amateur service. In the event of an emergency which necessitates invoking the President's War Emergency Powers under the provisions of section 706 of the Communications Act of 1934, as amended, 47 U.S.C. 606, RACES stations and amateur stations participating in RACES may only transmit on the frequency segments authorized pursuant to part 214 of this chapter.

(c) A RACES station may only communicate with:

(1) Another RACES station;
(2) An amateur station registered with a civil defense organization;
(3) A United States Government station authorized by the responsible agency to communicate with RACES stations;
(4) A station in a service regulated by the FCC whenever such communication is authorized by the FCC.

(d) An amateur station registered with a civil defense organization may only communicate with:
   (1) A RACES station licensed to the civil defense organization with which the amateur station is registered;
   (2) The following stations upon authorization of the responsible civil defense official for the organization with which the amateur station is registered:
      (i) A RACES station licensed to another civil defense organization;
      (ii) amateur station registered with the same or another civil defense organization;
      (iii) United States Government station authorized by the responsible agency to communicate with RACES stations; and
      (iv) A station in a service regulated by the FCC whenever such communication is authorized by the FCC.

(e) All communications transmitted in RACES must be specifically authorized by the civil defense organization for the area served. Only civil defense communications of the following types may be transmitted:
   (1) Messages concerning impending or actual conditions jeopardizing the public safety, or affecting the national defense or security during periods of local, regional, or national civil emergencies;
   (2) Messages directly concerning the immediate safety of life of individuals, the immediate protection of property, maintenance of law and order, alleviation of human suffering and need, and the combating of armed attack or sabotage;
   (3) Messages directly concerning the accumulation and dissemination of public information or instructions to the civilian population essential to the activities of the civil defense organization or other authorized governmental or relief agencies; and
   (4) Communications for RACES training drills and tests necessary to ensure the establishment and maintenance of orderly and efficient operation of the RACES as ordered by the responsible civil defense organization served. Such drills and tests may not exceed a total time of 1 hour per week. With the approval of the chief officer for emergency planning in the applicable State, Commonwealth, District or territory, however, such tests and drills may be conducted for a period not to exceed 72 hours no more than twice in any calendar year.

§ 97.501: Qualifying for an amateur operator license.

Each applicant must pass an examination for a new amateur operator license grant and for each change in operator class. Each applicant for the class of operator license grant specified below must pass, or otherwise receive examination credit for, the following examination elements:

(a) Amateur Extra Class operator: Elements 2, 3, and 4;
(b) General Class operator: Elements 2 and 3;
(c) Technician Class operator: Element 2.

[65 FR 6550, Feb. 10, 2000, as amended at 72 FR 3082, Jan. 24, 2007]

§ 97.503: Element standards.

A written examination must be such as to prove that the examinee possesses the operational and technical qualifications required to perform properly the duties of an amateur service licensee. Each written examination must be comprised of a question set as follows:

(a) Element 2: 35 questions concerning the privileges of a Technician Class operator license. The minimum passing score is 26 questions answered correctly.
(b) Element 3: 35 questions concerning the privileges of a General Class operator license. The minimum passing score is 26 questions answered correctly.
(c) Element 4: 50 questions concerning the privileges of an Amateur Extra Class operator license. The minimum passing score is 37 questions answered correctly.


§ 97.505: Element credit.

(a) The administering VEs must give credit as specified below to an examinee holding any of the following license grants or license documents:

(1) An unexpired (or expired but within the grace period for renewal) FCC-granted Advanced Class operator license grant: Elements 2 and 3.
(2) An unexpired (or expired but within the grace period for renewal) FCC-granted General Class operator license grant: Elements 2 and 3.
(3) An unexpired (or expired but within the grace period for renewal) FCC-granted Technician or Technician Plus Class operator (including a Technician Class operator license granted before February 14, 1991) license grant: Element 2.
(4) An expired FCC-issued Technician Class operator license document granted before March 21, 1987; Element 3.
(5) A CSCE: Each element the CSCE indicates the examinee passed within the previous 365 days.
(b) No examination credit, except as herein provided, shall be allowed on the basis of holding or having held any other license grant or document.


§ 97.507: Preparing an examination.

(a) Each telegraphy message and each written question set administered to an examinee must be prepared by a VE holding an Amateur Extra Class operator license. A telegraphy message or written question set may also be prepared for the following elements by a VE holding an operator license of the class indicated:

   (1) Element 3: Advanced Class operator.
   (2) Elements 1 and 2: Advanced or General Class operators.

(b) Each question set administered to an examinee must utilize questions taken from the applicable question pool.

(c) Each telegraphy message and each written question set administered to an examinee for an amateur operator license must be prepared, or obtained from a supplier, by the administering VEs according to instructions from the coordinating VEC.

(d) A telegraphy examination must consist of a message sent in the international Morse code at no less than the prescribed speed for a minimum of 5 minutes. The message must contain each required telegraphy character at least once. No message known to the examinee may be administered in a telegraphy examination. Each 5 letters of the alphabet must be counted as 1 word. Each numeral, punctuation mark and prosign must be counted as 2 letters of the alphabet.


§ 97.509: Administering VE requirements.

(a) Each examination for an amateur operator license must be administered by a team of at least 3 VEs at an examination session coordinated by a VEC. The number of examinees at the session may be limited.

(b) Each administering VE must:

   (1) Be accredited by the coordinating VEC;
   (2) Be at least 18 years of age;
   (3) Be a person who holds an amateur operator license of the class specified below:

      (i) Amateur Extra, Advanced or General Class in order to administer a Technician Class operator license examination;
      (ii) Amateur Extra or Advanced Class in order to administer a General Class operator license examination;
(iii) Amateur Extra Class in order to administer an Amateur Extra Class operator license examination.

(4) Not be a person whose grant of an amateur station license or amateur operator license has ever been revoked or suspended.

(c) Each administering VE must be present and observing the examinee throughout the entire examination. The administering VEs are responsible for the proper conduct and necessary supervision of each examination. The administering VEs must immediately terminate the examination upon failure of the examinee to comply with their instructions.

(d) No VE may administer an examination to his or her spouse, children, grandchildren, stepchildren, parents, grandparents, stepparents, brothers, sisters, stepbrothers, stepsisters, aunts, uncles, nieces, nephews, and in-laws.

(e) No VE may administer or certify any examination by fraudulent means or for monetary or other consideration including reimbursement in any amount in excess of that permitted. Violation of this provision may result in the revocation of the grant of the VE's amateur station license and the suspension of the grant of the VE's amateur operator license.

(f) No examination that has been compromised shall be administered to any examinee. Neither the same telegraphy message nor the same question set may be re-administered to the same examinee.

(g) Passing a telegraphy receiving examination is adequate proof of an examinee's ability to both send and receive telegraphy. The administering VEs, however, may also include a sending segment in a telegraphy examination.

(h) Upon completion of each examination element, the administering VEs must immediately grade the examinee's answers. The administering VEs are responsible for determining the correctness of the examinee's answers.

(i) When the examinee is credited for all examination elements required for the operator license sought, 3 VEs must certify that the examinee is qualified for the license grant and that the VEs have complied with these administering VE requirements. The certifying VEs are jointly and individually accountable for the proper administration of each examination element reported. The certifying VEs may delegate to other qualified VEs their authority, but not their accountability, to administer individual elements of an examination.

(j) When the examinee does not score a passing grade on an examination element, the administering VEs must return the application document to the examinee and inform the examinee of the grade.

(k) The administering VEs must accommodate an examinee whose physical disabilities require a special examination procedure. The administering VEs may require a physician's certification indicating the nature of the disability before determining which, if any, special procedures must be used.

(l) The administering VEs must issue a CSCE to an examinee who scores a passing grade on an examination element.

(m) After the administration of a successful examination for an amateur operator license, the administering VEs must submit the application document to the coordinating VEC according to the coordinating VEC's instructions.
§ 97.511: Examinee conduct.
Each examinee must comply with the instructions given by the administering VEs.
[59 FR 54835, Nov. 2, 1994]

§ 97.513: VE session manager requirements.
(a) A VE session manager may be selected by the VE team for each examination session. The VE session manager must be accredited as a VE by the same VEC that coordinates the examination session. The VE session manager may serve concurrently as an administering VE.
(b) The VE session manager may carry on liaison between the VE team and the coordinating VEC.
(c) The VE session manager may organize activities at an examination session.

§§ 97.515-97.517: [Reserved]

§ 97.519: Coordinating examination sessions.
(a) A VEC must coordinate the efforts of VEs in preparing and administering examinations.
(b) At the completion of each examination session, the coordinating VEC must collect applicant information and test results from the administering VEs. The coordinating VEC must:
   (1) Screen collected information;
   (2) Resolve all discrepancies and verify that the VE's certifications are properly completed; and
   (3) For qualified examinees, forward electronically all required data to the FCC. All data forwarded must be retained for at least 15 months and must be made available to the FCC upon request.
(c) Each VEC must make any examination records available to the FCC, upon request.
(d) The FCC may:
   (1) Administer any examination element itself;
   (2) Readminister any examination element previously administered by VEs, either itself or under the supervision of a VEC or VEs designated by the FCC; or
(3) Cancel the operator/primary station license of any licensee who fails to appear for readministration of an examination when directed by the FCC, or who does not successfully complete any required element that is readministered. In an instance of such cancellation, the person will be granted an operator/primary station license consistent with completed examination elements that have not been invalidated by not appearing for, or by failing, the examination upon readministration.


§ 97.521: VEC qualifications.

No organization may serve as a VEC unless it has entered into a written agreement with the FCC. The VEC must abide by the terms of the agreement. In order to be eligible to be a VEC, the entity must:

(a) be an organization that exists for the purpose of furthering the amateur service;
(b) be capable of serving as a VEC in at least the VEC region (see appendix 2) proposed;
(c) agree to coordinate examinations for any class of amateur operator license;
(d) agree to assure that, for any examination, every examinee qualified under these rules is registered without regard to race, sex, religion, national origin or membership (or lack thereof) in any amateur service organization;

[54 FR 25857, June 20, 1989, as amended at 58 FR 29127, May 19, 1993; 61 FR 9953, Mar. 12, 1996]

§ 97.523: Question pools.

All VECs must cooperate in maintaining one question pool for each written examination element. Each question pool must contain at least 10 times the number of questions required for a single examination. Each question pool must be published and made available to the public prior to its use for making a question set. Each question on each VEC question pool must be prepared by a VE holding the required FCC-issued operator license. See §97.507(a) of this part.

§ 97.525: Accrediting VEs.

(a) No VEC may accredit a person as a VE if:

(1) The person does not meet minimum VE statutory qualifications or minimum qualifications as prescribed by this part;
(2) The FCC does not accept the voluntary and uncompensated services of the person;
(3) The VEC determines that the person is not competent to perform the VE functions; or
(4) The VEC determines that questions of the person's integrity or honesty could compromise the examinations.
(b) Each VEC must seek a broad representation of amateur operators to be VEs. No VEC may discriminate in accrediting VEs on the basis of race, sex, religion or national origin; nor on the basis of membership (or lack thereof) in an amateur service organization; nor on the basis of the person accepting or declining to accept reimbursement.

§ 97.527: Reimbursement for expenses.

VEs and VECs may be reimbursed by examinees for out-of-pocket expenses incurred in preparing, processing, administering, or coordinating an examination for an amateur operator license.

[66 FR 20752, Apr. 25, 2001]

Appendix 1 to Part 97—Places Where the Amateur Service is Regulated by the FCC

In ITU Region 2, the amateur service is regulated by the FCC within the territorial limits of the 50 United States, District of Columbia, Caribbean Insular areas [Commonwealth of Puerto Rico, United States Virgin Islands (50 islets and cays) and Navassa Island], and Johnston Island (Islets East, Johnston, North and Sand) and Midway Island (Islets Eastern and Sand) in the Pacific Insular areas.

In ITU Region 3, the amateur service is regulated by the FCC within the Pacific Insular territorial limits of American Samoa (seven islands), Baker Island, Commonwealth of Northern Mariana Islands, Guam Island, Howland Island, Jarvis Island, Kingman Reef, Palmyra Island (more than 50 islets) and Wake Island (Islets Peale, Wake and Wilkes).

Appendix 2 to Part 97—VEC Regions

3. Delaware, District of Columbia, Maryland and Pennsylvania.
5. Arkansas, Louisiana, Mississippi, New Mexico, Oklahoma and Texas.
6. California.
8. Michigan, Ohio and West Virginia.
10. Colorado, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota and South Dakota.
11. Alaska.
12. Caribbean Insular areas.
13. Hawaii and Pacific Insular areas.
Appendix C: Resources
Resources for Amateur Radio and Emergency Management

Amateur Position Reporting Service http://www.aprs.net/
ARRL and ARES http://www.arrl.org

Automatic Position Reporting Service: A system used to transmit position reports, weather reports, and messages between users. http://www.aprs.net/


Example Manual: Arlington County, VA, Auxiliary Communications Service (ACS) and RACES http://www.w4ava.org/races/auxcomm01.htm


FEMA Mapping and Analysis Center https://gis.fema.gov/

Ham Radio on the Net (forums and resources) http://www.eham.net/
HIPAA Privacy Rule http://www.hhs.gov/ocr/privacy/index.html
List of Amateur Radio Groups http://www.arrl.org/find-a-club

MapWindow: Open-source GIS software that can be freely downloaded and customized to add functionality. http://www.mapwindow.org/

National Traffic System (NTS): Routes formal written message traffic (radiograms) from any location in the U.S. to another http://www.arrl.org/nts


NIMS http://www.fema.gov/national-incident-management-system


RACES http://usraces.org

Radio Emergency Associated Communications Team (REACT) – Citizens Band (CB) Radio group http://www.reactintl.org/

Sample MOUs http://www.arrl.org/served-agencies-and-partners


Web Services for Ham Radio Operators http://www.qsl.net
**Xastir**: Open-source computer application that provides real-time tracking & messaging of stations via radio/internet APRS data streams, with 125 map formats supported
http://www.xastir.org/
Appendix D: Sample RACES Plan
Sample RACES Plan

Appendix D: Sample RACES Plan Pdf
Appendix E: HIPAA Privacy Rule Decision Flow Chart
Appendix E: HIPAA Privacy Rule Decision Flow Chart Description

At a Glance – May I disclose protective health information for public health emergency preparedness purposes?
(From the perspective of the source of the information)
This flowchart is split into 4 sections: Section 1: Disclosure to a Public Health Authority; Section 2: Disclosures related to treatment & public health; Section 3: Disclosure of a Limited Data Set; and Section 4: Disclosure with individual authorization.
Start in Section 1: Disclosure to a Public Health Authority – Am I a covered entity? §160.103. If no, The Privacy Rule does not apply to non-HIPAA covered entities. Disclosures can be made without regard to the Privacy Rule.
If yes, Is the intended recipient a public health authority (PHA)? §164.501. If yes, Is the PHA authorized by law to collect or receive information for the purpose of preventing or controlling:
- Disease
- Injury, or
- Disability
Including, for purposes of emergency preparedness? §164.512(b)(1)(l).
If yes, skip to Section 3: Disclosure of a Limited Data Set – You may make a disclosure subject to minimum necessary, §164.502(b), §164.514(d).
If no, move to Section 3: Disclosure of a Limited Data Set – Are you disclosing only a limited data set (LDS)? §164.514(e). If yes, Do you have a data use agreement with the recipient of the
information? §164.514(e). If yes, You may make a disclosure subject to minimum necessary. §164.502(b), §164.514(d). If no, move to Section 4: Disclosure with individual authorization – Obtain individual authorization, unless the disclosure is otherwise permitted by another provision of the Privacy Rule §164.508.

Back to Section 1: Disclosure to a Public Health Authority – Is the intended recipient a public health authority (PHA)? §164.501 If no, move to Section 2: Disclosures related to treatment & public health – Is the intended recipient an agency that seeks information for public health purposes?

If no, Is the intended recipient a health care provider that uses or discloses information for treatment purposes? If no, Is the disclosure by a provider and is the recipient another person or agency that would use or disclose information for treatment or certain health care operations? If no, The disclosure may NOT be made unless there is a signed authorization.

Section 2: Disclosures related to treatment & public health – Is the intended recipient a health care provider that uses or discloses information for treatment purposes? If yes, move to Section 4: Disclosure with individual authorization – The disclosure can be made.

Section 2: Disclosures related to treatment & public health – Is the disclosure by a provider and is the recipient another person or agency that would use or disclose information for treatment or certain health care operations? If yes, move to Section 3: Disclosure of a Limited Data Set – You may make a disclosure subject to minimum necessary. §164.502(b), §164.514(d).

Section 2: Disclosures related to treatment & public health – Is the intended recipient an agency that seeks information for public health purposes? If yes, move to Section 3: Disclosure of a Limited Data Set – Are you disclosing only a limited data set (LDS)? §164.514(e). If no, move to Section 4: Disclosure with individual authorization – Obtain individual authorization, unless the disclosure is otherwise permitted by another provision of the Privacy Rule. §164.508.

Section 3: Disclosure of a Limited Data Set – Are you disclosing only a limited data set (LDS)? §164.514(e). If yes, Do you have a data use agreement with the recipient of the information? §164.514(e). If yes, You may make disclosure subject to minimum necessary. §164.502(b), §164.514(d). If no, move to Section 4: Disclosure with individual authorization – Obtain individual authorization, unless the disclosure is otherwise permitted by another provision of the Privacy Rule. §164.508.
Appendix F: U.S. Frequency Allocation Chart
U.S. Frequency Allocation Chart

The U.S. Frequency Allocation Chart can be found at: https://www.ntia.doc.gov/files/ntia/publications/2003-allochrt.pdf

The text version can be found at: https://www.fcc.gov/engineering-technology/policy-and-rules-division/general/radio-spectrum-allocation
Appendix G: Glossary of Communications Terms
Glossary of Communications Terms

Analog (vs. Digital)
Antennas
Computer Aided Dispatch Systems
Digital
Digital Status Tracking
Dual-Mode Radios
Fiber Optics
Frequency Synthesizer
Hazmat Incident Communications
Microwave
Mobile Command Post Development
Mobile Data Terminals and Lap Tops
Modes and/or Modulation - CW, AM, FM, SSB, Fax, Voice, Digital, Video, Etc.
Packet Radio
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Transportability vs. Fixed vs. Mobile

Analog (vs. Digital)

Voice or sound waves transmitted over telephone lines are converted into electrical Analog waves. As the analog wave is transmitted over the telephone line, the strength of the signal fades. Amplifiers are placed in the line to counter this fading. However, amplifiers also intensify any other noise along the line. When the analog signal reaches the receiver, it is converted back into sound waves, which include the voice message as well as the line noise that was picked up in transmission.
To overcome background noise, analog signals are transmitted as Digital data. Digital signals also lose strength and pick up background noise in transmission. Repeaters along the transmission lines reshape the data bits and filter out the noise to prevent loss of information and to preserve the accuracy and clarity of the original signal. The digital signal is converted back first into an analog signal and then into sound at the receiver - without the background noise the analog signal would carry.

Digital radios work in much the same manner. The radio signals are transmitted as data bits. When these data bits reach the receiver, they are reshaped and converted back into sound. This sound, or voice, is much clearer than an analog radio transmission would be. The only drawback to digital transmission is that it requires a wider bandwidth than an analog signal.

**Antennas**

**Antenna Set-up.** The correct type of Antenna set-up is critical for effective transmission and reception of signals. In setting up an antenna, it is important to make sure proper grounding is provided. In some set-ups a ground plane, or artificial ground is used. Also important is the orientation of the antenna. Antenna

**Tuners/Couplers.** Antennas, when transmitting a signal, radiate the signal, and antennas, when receiving, are tuned to the frequency that is to be received. Antenna Couplers and Automatic Antenna Tuners are used to adjust the match of an antenna to a transmitter and a receiver to attain the most efficient power transfer.

**Antenna Types and Length.** Antennas for HF are much longer than for UHF/VHF and range anywhere from 9 ft for a whip antenna to 150 ft or more for a long wire antenna. There are mobile antennas that are 12 ft minimum. In HF, NVIS antennas are used for close range communications. Antennas for VHF and UHF are much shorter than for HF and can be less than 1 foot.

**Antenna Backup.** A good antenna set-up is essential for many transmission. Antenna set ups can often be damaged by high winds, earthquake, or other event. It is therefore recommended that Emergency Operating Centers and other offices of emergency services maintain a back-up antenna system.

**Computer Aided Dispatch Systems**

Computer Aided Dispatch (CAD) systems have been used in public safety dispatch centers for many years. They were originally used in law enforcement dispatch operations in the early 1970’s and eventually migrated to fire and EMS dispatch centers. The early fire and EMS CAD systems were converted from police CAD systems. Due to the differences in these public safety sectors the converted CAD’s were not acceptable. Software programs were subsequently written specifically for fire and EMS dispatch to meet the needs of these agencies.

The CAD system is designed to track availability of all units in an organization and assign the closest available units to an incident. When the location and type of emergency is entered into the computer, the CAD determines the appropriate type and number of units that are available and recommends that they be dispatched. Most CAD systems have such features as dispatching by address, telephone number, intersection, fire or police call box number, business name, landmark, electronic alarm or through an Enhanced 911 interface from the telephone to the computer.
CAD systems should be designed to meet the specific needs of a communications center with quick, easy and fluid data entry. They should also allow for automatic transfer of data from dispatch files to management files. Many CAD systems are capable of including Management Information System (MIS) functions as a tool for managers. Some agencies have gone so far as to network their CAD computers throughout all agency facilities and in some cases into other agency’s facilities. In this manner, individuals can enter data directly into MIS and other members can gather data and statistics as they are generated.

Digital
See ANALOG (VS. DIGITAL)

Digital Status Tracking
Digital Status Tracking (DST) units can be employed in Mobile Data Terminals, Lap Tops and Automatic Vehicle Locator systems. DST units allow for short, pre-determined messages to be sent by radio in data bursts at the touch of a button. Such messages identify the unit transmitting the message and give unit information such as “responding”, “arrived at the scene”, “driver out of vehicle”, or, in the case of Emergency Medical Services vehicles, the hospital where the patient is being transported and the patient’s status. Radio and computer interfaces at the communications center allow this information to be entered into the data base with the time accurately recorded.

Dual-Mode Radios
Dual-Mode Radios have the capability of transmitting either analog or digital signals to either conventional or trunked systems. They are currently in the developmental stages and will need to meet the requirements of APCO Project 25 prior to being licensed by the Federal Communications Commission for use by public safety agencies.

Fiber Optics
Fiber optic cable is constructed of hair-thin optical fibers that conduct light and are encased in several layers of a protective covering. It is driven by a flashing light source and is a point-to-point medium that conducts light to a receiver which detects the flashing and recreates the data transmitted. This technology eliminates static, delays, echoes and other transmission problems. A pair of fiber optic strands, the size of a human hair, can carry as much traffic as 24,000 copper wires and deliver the information to the receiver much more clearly.

Both lasers and light emitting diodes (LED’s) are used as light sources while photo diodes are used as receivers. The greatest advantage of fiber optics is its ability to offer the user many choices in data transmission speeds including data rates far above other methods of data transmission. Fiber bandwidth is wide enough to establish digital networks, enabling work stations to use voice, data, real-time video, still images and other media in business applications and communications. Fiber optic networks also offer the user greatly improved data security while insuring that the data is immune to interference from radio frequency and electromagnetic sources.

Frequency Synthesizer
A Frequency Synthesizer is a frequency generating circuit which, through digital multiplications and divisions, will produce transmit/receive frequencies in a programmable radio. It is used whenever the need exists to change operating frequencies often and without prior knowledge of what frequency will be needed.
Hazmat Incident Communications

An area where good communications is absolutely essential is when wearing an encapsulated suit at the scene of a Hazardous Materials (HazMat) incident. Emergency workers in encapsulated suits are vulnerable to many problems. They must depend on self-contained breathing apparatus and on portable radios. Unless there is a separate channel or radio frequency for HazMat incidents, other radio traffic may keep a HazMat team member from transmitting pertinent information concerning the material involved or calling for help if they are experiencing an emergency.

A radio system that is suited for such situations is one that is completely portable with separate channels and can be used while wearing an encapsulated suit. Radios can be voice activated (VOX) or keyed by a push-to-talk button. The advantage of VOX is that it eliminates the difficulty of pushing a button while wearing gloves or fumbling through the suit. The user needs only to speak to activate a throat or boom microphone in order to transmit. The user receives messages through an ear piece. The radios themselves must be such that they will fit under the containment suit, including the antenna. With separate repeated channels, several radio users can communicate without interfering with each other and urgent messages can be transmitted without waiting for a clear channel. The repeater feature allows all team members to hear each other’s messages so each person is aware of what is going on.

Microwave

Microwave systems operate in the 2 to 16 GHz frequency range. Microwave circuits, also called “links”, have the advantage of a very wide bandwidth. As a result they can handle several channels of radio traffic at the same time. The microwave antenna is a “dish” shaped object. Instead of radiating radio signals in all directions, the microwave antenna directs all of its energy toward a definite object, another dish antenna.

Mobile Command Post Development

Developing a Mobile Command Post depends on the needs as perceived by the local community and the availability of funding. Mobile Command Posts have been built in used city busses, new mobile homes, former modular ambulances, step vans, tractor- trailers, modular pods and passenger vans. In fact, the vehicle in which a mobile command post is built is limited only by the imagination of those constructing it.

This discussion is not intended to give specific directions for building a mobile command post, but to name items that are being used by other mobile command posts in different parts of the country. The type of vehicle that is selected will depend on the needs of the users. A large mobile home or converted transit bus would not be expected to respond at high speed through city streets and park directly in front of a major incident. Agencies wanting this type of response would do better with a converted ambulance or passenger van. Conversely, a community that desires to develop a mobile command post that could be used for extended emergency scene operations would not want a small vehicle in which the incident commanders would be cramped together in a confined space.

Equipping a mobile command post would include the following components:

A power supply, either a generator or a power inverter, capable of supplying all the electrical equipment found on the vehicle.
Mobile radios capable of communicating with all public safety agencies in the response area. These could include low band, VHF, UHF, 800 MHz and the higher bandwidths if necessary. Programmable radios may be necessary, depending on the number of frequencies that may be used. Also, a scanner capable of monitoring all radio bands in the area. Portable radios capable of the same coverage as the mobile radios, along with spare batteries and rapid chargers would also be necessary.

Since many areas have ham radio operators that assist during emergency or disaster operations, the vehicle should also be equipped with two-meter ham radio capabilities. A paging terminal, complete with encoder, capable of paging individual pagers or doing an “all call” page. This unit should also be capable of activating siren alerting systems in areas where they are still being used.

Cellular telephone(s) capable of radio/telephone interconnect as well as interfacing with an on-board FAX unit. The FAX unit would be used to transmit and receive information as well as provide copier capability of documents on-scene.

Television monitors that would enable those in the command post to monitor news telecasts to verify media coverage of incidents. The monitors should also have video record and playback capabilities. There should also be a portable video camera or camcorder to record the incident for review by the command staff in the vehicle. These recordings could also be used for critiques at a later time.

Adequate lighting inside and outside the vehicle.

A hazardous materials library with chemical manuals to allow the command post members the ability to identify hazardous materials. In this vein, an on-board computer system with a CAMEO program would also be worthwhile. The computer could also have other MS-DOS operated programs loaded in it to allow reports to be filed while on the scene of an incident. If a modem is available and the local Emergency Operations Center operates with a computer aided dispatch (CAD) system, the on-board computer could access the CAD system for unit availability at any time. Messages could also be sent directly to the CAD without having to relay them through the radio. Mobile Data Terminals (MDT’s) and/or Laptop Computers could have the same abilities. A printer would also allow hard copy of transmitted or received information.

There should be an exterior means to identify the vehicle as the Command Post. This could be by a flashing strobe light, a flag or a helium balloon flying over the vehicle. A large awning going across the side of the vehicle is an item that is very useful. In this manner those working at the scene of an incident can be briefed under some type of cover in case of inclement weather or on extremely sunny days.

Vehicles designed for long term operations should have restroom and kitchen facilities and a conference area. Equipping the conference area with desks or tables which have a white porcelain-type finish tops, dry-erase markers can be used and the entire desk or table top becomes a “scratch pad.” Acoustical wall coverings will help to reduce noise. Tinted windows with mini blinds add to privacy and air conditioning will keep the inside of the vehicle from becoming uncomfortable.

When a mobile command post is being designed and/or constructed, the input of those who will work in it should be considered. Also, the talents of those who will either operate in or around the vehicle may be used in its construction. This is one way to help keep the costs of such a vehicle from becoming prohibitive.
Mobile Data Terminals and Lap Tops
Mobile Data Terminals (MDT’s) are a means to transmit information to and receive information from vehicles. MDT’s are small computer terminals with alphanumeric keyboards designed for mobile use. They will operate through VHF, UHF and 800 MHz radios, interfacing through the radio to a central computer at a communications center. Data is transmitted and received quickly and accurately without the delays and errors that are common in voice communications. Since MDT’s do not rely on voice communications, radio congestion is decreased. Message security and privacy are also ensured as only the designated terminal will receive the data. The vehicle operator does not need to be in the vehicle when a message is received. The MDT will store it and advise the operator that there is a message waiting. Inquiries from an MDT may be made directly into the central computer’s data base. Reports and incident information may also be sent directly to a computer’s data base from the scene of an incident. The data is digitized and transmitted in short data bursts over the radio channels.

There are several drawbacks to the Mobile Data Terminal. The amount of memory and the size of the screens are limited. MDT’s communicate at different speeds, ranging from 300 to 9600 bits per second, depending on the model and manufacture. Some MDT’s are not compatible with trunked radio systems. Unlike the computer industry, very little standardization has taken place for terminal to radio interfacing.

An alternative to the MDT is the Laptop Computer communicating through a vehicular radio using a radio frequency modem for transmitting and receiving information. Laptops offer basically the same features that a full size personal computer offers. They are small, portable and designed to operate either by internal battery or external power source. Screen sizes are usually larger than those found on an MDT. The development of these units has progressed to where they are rugged enough to withstand the jostling associated with being mounted in a vehicle. Laptops can be either removable as portable units or they can be permanently mounted in a vehicle as an MDT.

Using a Laptop instead of an MDT has some tangible benefits. The Laptop becomes a communications terminal for field personnel without being dependent on host computer driven software. Computer programs such as MS-DOS, word processing or spread sheets can be run while still maintaining radio contact with the communications center.

Modes and/or Modulation - CW, AM, FM, SSB, Fax, Voice, Digital, Video, Etc.
Modulation is defined as a variation in amplitude, frequency, or phase of a wave in accordance with some signal. It is the means by which voice, i.e., words, are introduced onto a radio wave signal.

“CW”, or Continuous Wave, is the wave that is generated when a transmitter is turned on and a tone signal created that can be picked up by a receiver. Morse code can be transmitted by a Continuous Wave transmitter. The transmitter sends out continuous wave signals that are picked up by the receiver and the message interpreted by the “dots” and “dashes” that are sent.

“AM”, or Amplitude Modulation, is the type of radio signal found in the entertainment frequencies of a radio that receives in the 560 to 1600 Khz range. It uses up a large portion of the radio spectrum, is not energy efficient and is very vulnerable to noise.
Frequency Modulation, or “FM”, radio signals can be transmitted on equipment smaller in size than AM transmitters and are not as prone to noise interference as AM signals are. Entertainment radios broadcast FM signals as the fidelity is higher. Public safety agencies may also broadcast on FM bands, but the biggest difference is that the public safety agencies use a narrower bandwidth than the entertainment radio stations use. The narrower bandwidth allows the transmitted information to be passed along using a smaller amount of the radio frequency spectrum. This is important since the narrower bandwidth allows for more radio channels in the frequency spectrum.

Single Sideband, or “SSB”, is a narrow band AM transmission medium. One of the positive aspects of SSB is that there is little or no power usage when the unit is not transmitting. This is important when the unit is a battery operated portable radio. One drawback is that, since it is an AM unit, it is susceptible to noise interference.

When using a radio, Voice communications occurs when a person speaks into a microphone and the sounds or words are converted into electrical impulses. These impulses are then amplified and transmitted to a receiver which converts them back to sounds or words. The normal voice range is between 300 KHz and 3000 KHz.

Fax or facsimile, refers to the transmission and reproduction of graphic matter by an electronic device, either over telephone lines or by means of a radio system. The images are converted into electrical impulses. These impulses are then amplified and transmitted to a receiving unit which converts them back to graphic images.

In Digital applications, letters, numbers and symbols are represented by two voltage levels known as zeroes and ones or “logic 0” and “logic 1.” The frequency, absence or presence of these zeroes and ones, or other properties such as duration and spacing, communicate the information even though the digital signal has only two specific voltage levels.

Video transmission refers to images being picked up by a camera and converted into electrical impulses. These impulses are then amplified and transmitted by either radio waves or hard wire to a receiving unit. These impulses are then converted back to an image and projected onto a video screen where they can be viewed.

Packet Radio
An alternative to land lines and cables is a Data Radio System which is used for transmitting and receiving digital information. These radio Systems operate on conventional VHF or UHF radio frequencies and are flexible enough to be networked with random access from station to station.

In a data radio system, the digitized information can be grouped into chunks, or “packets”, whose size is specified for the convenience of the network. This type of system is known as Packet Radio. Each packet contains the destination address where it is directed, the source address to indicate where it originated, a “flag”, or control byte, which indicates the type of information in the packet, a sequence number so duplicate packets will be recognized and rejected, and the information data itself. Messages greater than packet size are broken into several packets for transmitting. Messages smaller than packet size are transmitted as a partial packet.

Phone Patch
Phone Patch is a unit that allows for the interface of the terrestrial telephone network with a radio transmitter or receiver.

Power Supply
A power supply is the part of an electrical device that supplies the current, thereby allowing the unit to operate in the manner that it was designed. Power supplies can be in the form of A/C or D/C circuits, batteries, solar cells, transformers or motor driven generators. Some communications equipment is designed so that a DC power supply takes over upon the failure of an AC power supply.

**Power Output**

Power output is measured in WATTS. The higher the power output (a higher wattage) usually is an indication that the output signal is stronger, and can travel further and overpower weaker signals that are interfering on a nearby frequency. As examples of power output, for radio communications, the output power of a radio system (which can vary in range) could be: a radio station in the EBS may output at 50,000 - 100,000 watts (or more); whereas a handheld VHF/UHF radios may operate at 5 watts, and HF Base stations may output at 1 Kwatt, with HF held radio possibly at 125 watts. Cellular telephone may operate at 3 watts or lower.

**Propagation**

Propagation refers to the movement of a radio frequency signal travelling through a transmission medium. In radio communications, voice and data are transmitted in the form of radio waves. Radio wave propagation, then, refers to a radio communication signal travelling from an antenna, along or through a transmission medium such as along the ground (ground waves) or through the earth’s atmosphere.

HF radio waves can propagate as ground waves, and also via the part of the earth’s atmosphere called the ionosphere (sky waves). (Because the ionosphere encircles the earth, it allows for long range communications with HF radio).

VHF/UHF radio waves propagate through the atmosphere and travel as space waves in straight lines and can be obstructed by buildings, hills, and trees.

Terrestrial land line communications propagates the signal via cables. (e.g. twisted pair telephone hard wire, fiber optics, etc.)

**Repeater**

The Repeater consists basically of a transmitter and a receiver linked together with different transmit and receive frequencies. The receiver part picks up radio signals made by other transmitters on the receive frequency. These messages, or signals, are then transferred to the transmitter part of the unit and rebroadcast on the transmit frequency. The frequencies of the transmitter and the receiver must be separated enough so the repeater does not interfere with itself.

**Satellite**

Satellites act as repeaters, or relay stations, for communications systems. Most of the ones used for public safety communications are in what is known as a geosynchronous orbit. This orbit is approximately 22,000 miles above the earth, over the equator. The satellite’s rotation is set to match the earth’s rotation so it appears that the satellite is in a fixed location. Some satellites also operate at lower levels, i.e., from 150 to 500 miles above the earth. These are known as Low Earth Orbit (LEO) satellites. Satellites are used for audio, data, telephony and video communications.

**Signal Degradation: Interference, Attenuation, Noise, Intermodulation**
Radio waves, like light waves, travel in straight lines, although there is a slight deviation due to the earth’s curvature. As radio waves travel over a distance, they lose the strength and clarity that they were originally broadcast with. This loss of strength and clarity is known as Signal Degradation.

Attenuation refers to power loss and refers to the loss or diminishing of electronic signal strength through absorption by solid objects or atmospheric conditions. Attenuation of signal can be caused by vegetation and building (obstacles). Interference refers to the disruption of the proper operation of electronic equipment due to undesired signals and/or voltages being introduced into circuits that were designed for another purpose. This interference could lead to signal degradation in that the broadcast signals could be disrupted at the time of transmission.

Interference of two signals of same frequency can result in the signals adding, or canceling, each other. Diffraction of radio waves can be caused by objects on the earth’s surface.

Deflection of radio waves, called multipath, affects mobile communications. Multipath fading can occur when a signal has traveled over more than one path. Precipitation causes degradation of signals above 1 GHz. For signals in the HF range, the usefulness of a signal on a specific frequency depends on the season and time of day due to the sun. Solar disturbances and irregularities in the ionosphere can cause signal black-outs.

**Trunking**

Trunking is basically radio spectrum management with computerized frequency selection and transmitter assignment. It is a form of electronic switching that selects available radio channels for users wishing to make transmissions and drops radio users from the channel when their transmissions cease. Unused channels are then immediately made available to other radio users wishing to make transmissions. In this manner the trunked radio system ensures that unused frequencies in the system are available to any radio operator. This allows for a more efficient use of the available radio frequency spectrum and reduces waiting time to make radio transmissions. It also virtually eliminates the problem of radio transmissions being “stepped on.”

Trunking systems can be designed for one agency or all agencies in a municipality. However, if the system is to be used for public safety, it must meet the requirements of APCO Project 16. Agencies operating on an area wide trunked system will contact only those radios in their own system. However, if the need should arise, all agencies in a municipality can communicate with each other through an interoperability feature in time of emergency or disaster. This is a feature that has been particularly valuable for some cities when natural disasters such as hurricanes or tornadoes strike.

**Tunnel (Underground) Communications**

Good communications is absolutely essential in tunnel or underground operations. Many communities have networks of tunnels running beneath their streets for subways, trains, motor vehicles or public utilities. Incidents that occur in these tunnels can be very taxing on public service resources. They can also have tragic results.

Probably the most common tunnel communications antenna system is the radiating slotted coaxial cable, or “leaky line” antenna. This cable functions as a continuous antenna throughout the tunnel. Slots in the corrugated copper outer conductor allow the transmitted radio frequency signal to radiate out along the entire length of the cable. A signal transmitted from a hand held or mobile radio near the cable will couple into these slots and be carried along the cable. The cable...
can be run or routed wherever signal coverage is needed. However, amplifiers must be placed at various locations to ensure that the signal is strong enough to cover the entire system.

(The radiating slotted coaxial cable is the type of antenna system currently in use in the tunnel that is being constructed under the English Channel. A single cable system with bi-directional amplifiers was selected for the construction phase of the tunnel. This antenna system is supporting six base stations and numerous hand held and mobile radios as well as a paging system in each of the three tubes being built.)

Another type of tunnel antenna system is being used in the subway system in Toronto, Ontario. This system uses low loss coaxial cable coupled into VHF and UHF antennas spaced at two hundred foot intervals. Transmit and receive antennas are altered along the tunnel. Amplifiers and repeaters in the system allow radio signals to move through the tunnel to an above ground antenna located in downtown Toronto. The system is designed to support the VHF, UHF and 800 MHz radio frequencies used by the different public safety agencies in the City.

A free standing antenna system can also be built into a tunnel. By using high gain directional antennas, radio signals can be “shot” through a tunnel. The signal goes from one antenna to the next with each one amplifying the radio signal as it sends it to the next antenna.

Since radio waves travel in the same manner as light waves, they do not go around corners. Therefore, whenever there is a turn or a corner in a tunnel a passive backfired corner antenna is used. The corner antenna is designed to pick up a signal coming from one direction and retransmit it in another direction. In this manner radio signals can be sent through a tunnel system without having to be transmitted through the cables that are associated with the radiating coaxial cable system or with an antenna system as is being used in Toronto.

**Underwater Communications**

There are several methods for divers to communicate while underwater, some used by public safety agencies. One of these consists of a full face piece for the diver which has earphones and a mouthpiece built into it. The diver is then connected through a hard wire which is built into a safety line that is attached from the diver to the dive boat. Another member stays on the boat and monitors the diver’s messages by means of a head set plugged into the wire in the safety line. This is a battery operated unit. The safety lines come in various lengths and can be connected to extend the line to the desired length.

There is also an underwater portable radio system that is used by some public safety agencies for their divers. It does not have the clarity of transmission that the hard wired unit has. However, with advances in technology, this type of system will probably be improved to the point of offering the same clarity as the hard wired units.

**Transportability vs. Fixed vs. Mobile**

**Fixed Station.** A fixed station (e.g. radio system) that is fixed in place and is set up with the intentions that it will permanently remain where it is set-up. Often, a fixed station is too heavy to move.

**Transportable Station.** Transportable stations are radio systems that can be transported from site to site. Transportable radios can be used for field operations.

**Mobile Stations.** Mobile Radios can be operated while in motion, such as in a Communications Van.
Deployable Systems. Deployable communications Systems are equipment that can be deployed to a site and then rapidly set up for operation (e.g., HF manpack, flyaway satellite earth station).