

The

# Modulator

Newsletter of the Newport County Radio Club, October 2018

John King, WA1ABI, SK

Long time club member John King became a Silent Key after a brief illness last month. John was the Emergency Management Director for the Town of Portsmouth, RI, and an electronics wizard.

His command of electronics was evident to all with his presentation of *The Magic Bus*. Bus was his analysis and explanation of how the *Super Pixie*, last year's QRP build project, gets transmit and receive out of such a simple circuit.

John was most visible to NCRC members as leader of our Nationally recognized Field Day operations. His meticulous planning and execution consistently put NCRC in the top five Field Day finishers nationally.

WA1ABI Field Day safety briefing

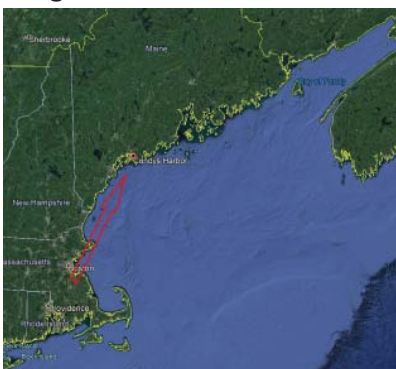


This year has seen the loss of three long-time NCRC stalwarts; Bob Day, AA1LG, Jim Kyle, KC1SD, and now John WA1ABI. All three made many significant contributions to the club; clearly they will be missed.

## Portable Operations (almost) Down East

### Activating Maine Islands

Those readers who have traveled the Maine Coast know that there are a bazillion Maine islands (over 3,000). Early this month, Pete, W1LAB, and Marshall Lawson invited the NCRC Island Activators to their fall rental in Cundy's Harbor for three days of radio adventures in this beautiful setting.



Cundy's Harbor in Casco Bay

John, K1JSM, Willy, W1LY, and Pete, W1LAB, activated both Bush and Flash Islands on October 3rd. The next day, they were joined by Jim, KA1ZOU, to activate Snow Island.



Flash Island granite at low tide

Snow Island is the 25th island that NCRC has activated since we started activating islands in 2014.



Morning light on Cundy's Harbor

### Propagation?

Although our equipment has been essentially the same over the years, we've found differences in propagation that invite questions. These islands and Gosnold Island saw the US-European stations ratio tip a bit toward the European stations. The Maine islands and Gosnold are right at the edge of a clear water path to Europe—significant?

Sound interesting? Most of our activations are one-day jaunts—come join us next season!



Maine—Got lobster?

## Jamboree On The Air—JOTA—2018!

### What is JOTA?

Jamboree On The Air is the biggest scouting event in the world. With support from radio clubs and individual hams, scouts from around the world get together on Amateur Radio frequencies.



CQ—JOTA

This will be the sixth year that NCRC has supported JOTA here on Aquidneck Island.

The weekend begins Friday afternoon as scout troops set up their tents in the camping area at Glen Farm in Portsmouth. Then comes the first of two campfire programs. As host, Portsmouth Troop 1 invites other troops to join them.



Recently Boy Scouts of America admitted girls into the scouting program, changing their name to Scouts BSA. Although it's probably too late for this year, perhaps we will have girls join us at Glen Farm next year.

### NCRC and Radio Merit Badge

As part of our support of JOTA, NCRC provides an opportunity for scouts to earn the Radio Merit Badge, one of the more prestigious, but difficult merit badges.

The difficulty lies in being able to access the equipment and Control Operators needed to meet the practical requirement. Clearly that is not a problem for us, so with a bit of careful planning, we have been able to see most scouts complete the badge during the weekend or soon after.

### Fine Tuning the System

The NCRC merit badge process has been streamlined for this year. We have set up the weekend with four parts:

1. Pre-JOTA preparation.
2. The Opening Class.
3. Hands-on operating.
4. Requirement Review Tables.

The Pre-JOTA packet is already in the hands of the scouts and their leaders, the Opening Class has been designed, and the Control Operators have been signed up. That leaves only one part to be completed.

### Calling Volunteers

The fourth part, the Requirement Review Tables, needs at least nine NCRC volunteers to meet with scouts to determine that each requirement has been fulfilled. This is not difficult because:

- The material is well within the Technician License level of radio knowledge.
- The intent is that the review is an easy-going conversa-

tion.

- The worse case is that a requirement is not yet completed, keep working on it.

We are asking for four and a half hours, 8:30 AM to 1:00 PM, of your Saturday morning, October 20th.

The following pages of the *Modulator* are the complete Volunteer Instructions packet. Please take a look at them, especially pages 3-7 that provide specific requirement guidelines, to get a feel for what to expect. That morning you will see the Opening Class, so you will have a clear idea about what the requirements are asking for. For new members, especially new Technicians, this is a good opportunity to get to know your club and you are encouraged to join in.

### Youth Protection

Scouts BSA has responsibility for the safety and well-being of girl and boy scouts in their activities. To serve this, they have developed their excellent Youth Protection program. One of the primary elements of Youth Protection is the Two Person rule—single adults are not allowed to be alone with single scouts. That means that should you arrive at one of the rest rooms and see that there is a scout already inside, you must wait outside until the scout leaves.

Please sign on soon by contacting Jim Sammons, KA1ZOU.

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# Volunteer Instructions Radio Merit Badge



## Radio Merit Badge

Jamboree On The Air – JOTA – is a radio activity sponsored by Scouts BSA. JOTA 2018 begins in just a short time from now, October 19th and 21st. While camping at fabulous Glen Farm in Portsmouth, RI, Scouts will have an opportunity to see, hear, and best of all, use Amateur Radio to talk to other JOTA Scouts around the world.

The Newport County Radio club offers scouts an opportunity for boy and girl Scouts to complete Radio Merit Badge, one of the more demanding badges, in the course of the JOTA weekend.



The NCRC Radio Merit Badge process is made up of four parts:

1. Pre-JOTA preparation by Scouts.
2. The Opening Class for requirements best handled in this format.
3. Hands-on operating at NCRC portable stations.
4. Requirement Review Tables staffed by NCRC JOTA volunteers.

This Volunteer Instructions packet includes everything that you will need to serve as a volunteer Saturday morning of the JOTA weekend. The merit badge process will begin at 8:30 AM and end by 1:00 PM.

## The merit badge process

### 1 Pre-JOTA Preparation

Before the JOTA weekend, Scouts will study and prepare those requirements that are best learned before the JOTA weekend. You will not be involved

in this part of the merit badge process, but you will review this work at the Review Tables.

1a-1d. Broadcast and hobby radio, Broadcasting and hobby radio, call signs, and the international Radiotelephony Alphabet.

6. Safety precautions.

8. Career exploration (written).

9a/a-9a/c. Amateur Service, licenses, and Q signals.

You will find the full set of requirements, *BSA Radio Merit Badge*, at the end of this packet.

### 2 The Opening Class

The Glen Farm pavilion contains multiple picnic tables. Here, the Saturday morning Opening Class will cover those requirements that are best served in this format:

- 1d. International radiotelephony Alphabet
2. Radio propagation, the FCC and ITU.
3. The radio spectrum.
4. How radio waves carry information.
5. Diagrams, modulation, weather radio, and cell phones.



This will be your first opportunity to assist Scouts by moving among the seats and assisting them in a low-key manner. Look for Scouts who are unsure of what they should draw/write, are having trouble seeing the projector screen, or are not keeping up.

During the Opening Class, small groups of Scouts will circulate between the pavilion and the radio stations set up in the stables.



# Volunteer Instructions

## Radio Merit Badge



### 3 Hands-on Radio Stations

The candidate will have an opportunity to visit and operate several ham radio stations during the JOTA weekend, thereby completing Requirements 7 and 9 and reinforcing the ideas of Requirement 4.



QRV at Glen farm

### Station Operators

New this year: If, but only if, you have time, we are asking the Station Operators to help out by reinforcing specific elements of the merit badge requirements. We are also asking that you mark the candidate's record for those requirement elements that are completed with your guidance.

### Opportunities for reinforcement

Requirement 4 asks the candidate how radio waves carry information and to include in their explanation *transceiver*, *transmitter*, *receiver*, *amplifier*, and *antenna*. This requirement will be covered in the Opening Class, but it would be valuable for you to point out this equipment so that each term is associated with an object.

Requirement 5b asks the candidate to "Draw a block diagram for a radio station that includes a *transceiver*, *amplifier*, *microphone*, *antenna*, and *feed line*." Again, this requirement will be covered in the Opening Class, but although the concept of a block diagram is straight-forward, the *order* of blocks will

be better understood if you take the time to point to each device in the signal path in its operating order for transmit and receive.

Requirement 7 asks, after visiting a radio station, the candidate to "Discuss what types of equipment you saw in use, how it was used, what types of licenses are required to operate and maintain the equipment, and the purpose of the station." If you have had time to address either of the preceding requirements, you probably will have covered this one too. Your most useful contribution for this requirement might be to describe your license class.

Requirement 9a/f asks the Scout, "Using proper call signs, Q signals, and abbreviations, [to] carry on a 10-minute real or simulated amateur radio contact using voice, Morse code, or digital mode." We take this requirement in a broad sense—in other words, let the contacts flow according to operating conditions. Please mark the candidate's 9a/f record before he/she leaves.

### 4 Requirement Review Tables

After the opening class, Scouts will visit the Requirement Review Tables staffed by NCRC volunteers. As the Opening Class ends, review volunteers will organize themselves at tables so that each requirement will be reviewed at one table by one or more volunteers. At the conclusion of each interview, the Scout will move on to a different table.



NCRC volunteers at the review tables



# Volunteer Instructions

## Radio Merit Badge



Some requirements are straight-forward and one reviewer may cover more than one of these quick reviews. Other requirements are more detailed and will take more time than others. Tables for those requirements may be staffed by more than one reviewer.

Please verify requirement completion and mark the Scout's Requirement Record accordingly. Make clear that the record is valuable should the Scout run out of time during the weekend. With the Requirement Record, missing elements can be completed after the JOTA weekend and the merit badge earned at a later date.

### Requirement Review Guidelines

- Most Scouts will be unsure of themselves and will be most successful if you take a moment to put them at ease. They will not know what to expect, so it will be up to you to lead the conversation.
- After introducing yourself and putting the Scout at ease, prompt by asking about each element of the requirement that you are reviewing.
- If a Scout is stumped by an element, move on to another suggesting that he/she can come back to that one later.
- Feel free to modify your approach.
- Indicate successful completion of each element by stamping in the provided location on the Scout's Requirement Record.
- Indicate successful completion of all elements of your assigned requirement by stamping in the provided location for *Requirement (number) Completed* on the Scout's Requirement Record.
- Partial completion of a requirement will be obvious by stamped elements without the *Requirement (number) Completed* stamp.
- These interviews do not need to be done in order, nor do they need to be done continuously. Scouts may leave the Requirement Review Tables and return later.

### Requirement Standards

Following are *Requirement Guidelines* to give you a sense of what to expect from Scouts for each requirement. Guidelines are preceded by bullets. The requirement review process is not intended to be a hard all or nothing bar and you are encouraged to use your good judgement where appropriate.

### Radio Merit Badge Requirement 1

Explain what radio is.

- Radio is wireless communication.
- Radio is communication via electromagnetic (OK to have other terms here) waves.

1a. Discuss the differences between broadcast radio and hobby radio.

- The intent of this question is to compare who uses radio and for what purpose.

Broadcast Radio

- Broadcast radio is primarily a business. Listeners are gathered by broadcast stations who providing entertainment, news, weather, and other topics of interest. Broadcast stations make money by providing access to those listeners in the form of paid advertising.

Hobby Radio

- Hobby radio is personalized and not a business. It includes ham radio, Citizen Band radio, remote controlled cars, boats, planes, and drones, and Family Radio Service (FRS) hand-helds.

1b. Discuss the differences between broadcasting and two-way communication.

- The intent of this question is to compare the management of these modes of communication.

Broadcast Radio

- Broadcast radio comes from a single station and is intended to be received/heard by many.
- Those receiving the broadcast do not communicate with the broadcaster.
- The receiving stations are unknown to the broadcaster.





# Requirement Guidelines

## Radio Merit Badge



### Requirement 1, Continued

#### Two-way communication

- The sender intends to communicate with another station and that station will communicate with the first.
- Both stations know, or come to know, each other.

#### 1c. Discuss radio station call signs and how they are used in broadcast radio and amateur radio.

- All radio stations are required to be identified by an assigned call sign.
- Call signs are important for receiving stations to find a transmitting station.
- Call signs are important for identifying a transmitter that may be interfering with other stations.
- Call signs are used by both broadcast and amateur radio for these reasons.

#### 1d. Discuss the phonetic alphabet.

- This requirement will have been done in the Opening Class.

### Radio Merit Badge Requirement 2

#### 2a. Sketch a diagram showing how radio waves travel locally and around the world.

- This sketch will have been prepared in the Opening Class. It should be complete, however, the quality of the sketch and the representation of Earth's surface are not being reviewed.
- Look to see ground waves travelling along Earth's surface (Local stations).
- Look to see sky waves being reflected from the ionosphere back to Earth's surface (DX stations).

#### 2b. Explain how the radio stations WWV and WWVH can be used to help determine what you can expect to hear when you listen to a shortwave radio.

- By listening for stations at known locations, we can get a sense of where we might be able to communicate.

#### 2c. Explain the difference between a distant (DX)

and a local station.

- Use the sketch from Requirement 2a as a background for this requirement. Guide the candidate to the relevant components as a means of integrating the concepts.
  - DX is the shorthand term for distant radio stations, local stations are just that.
  - The distinction between the two is arbitrary.
  - DX communication generally relies on skywave skip.
  - Local communication is most reliable via ground waves.
  - Clearly there are exceptions to both of the previous points, but they are beyond the scope of the merit badge and should not be pursued.
- #### 2d. Discuss what the Federal Communications Commission (FCC) does and how it is different from the International Telecommunication Union
- There are a great many stations that would like to communicate by radio. The FCC brings order to these stations, like a traffic cop directing traffic, by controlling the conditions that stations must follow to reduce interference. The FCC is a US agency and controls US stations.
  - Other countries have the same need to control inference and so have their own equivalent agencies like our FCC. But Radio waves do not stop at borders, so the ITU coordinates these many country FCC equivalent agencies so that radio communication is conformal world-wide.

### Radio Merit Badge Requirement 3

#### 3a. Draw a chart of the electromagnetic spectrum covering 300 kilohertz (kHz) to 3000 megahertz (MHz).

- This drawing will have been prepared in the Opening Class. It should clearly show the elements required, however, the quality of the sketch is not being reviewed.

#### 3b. Label the MF, HF, VHF, UHF, and microwave portions of the spectrum on your diagram.

- Look to see that the five ranges of radio frequencies are shown and labeled.



# Requirement Guidelines

## Radio Merit Badge



### Requirement 3, Continued

Consider the element complete if together you and the candidate can add a few missing pieces with a profitable conversation.

3c. Locate on your chart at least eight radio services, such as AM and FM commercial broadcast, citizens band (CB), television, amateur radio (at least four amateur radio bands), and public service (police and fire)

- Look to see that eight radio services are shown and labeled. Consider the element complete if nothing is written, but the candidate can point to a reasonable frequency for each service.
- Use your discretion if one or two services are missing. Consider the element complete if together you and the candidate can add these with a profitable conversation.
- This is an open-ended question and the candidate may have included services with which you are unfamiliar.

### Radio Merit Badge Requirement 4

4. Explain how radio waves carry information.

Include in your explanation: transceiver, transmitter, receiver, amplifier, and antenna

- This question is vague and leaves it up to the candidate and reviewer to determine what is relevant. In the course of your dialog, you may feel that you have been the source of important points. Use your discretion, but if you feel that anything that you have added to the conversation has been understood in a meaningful way, these additions should not bar completion of the element.

Note that the equipment order in the following general descriptions has been altered.

- Transmitter: Radio communication begins with a language or image source. It might be gathered by a keyboard, camera, key, or a microphone. All four of these gather language or images. The transmitter converts the source material into radio wave energy.

- Amplifier: Before this radio wave energy is fed to the antenna in the next step, it may be boosted by feeding it first through an amplifier. In this way a signal that left the transmitter at 100 watts, may arrive at the antenna at 600 watts.
- Antenna: Radio waves travel through space. Here, space includes our atmosphere. So the next step in radio communication is to move the radio wave energy from the transmitter to something that will send that energy out into space. That's the role of the antenna. The antenna converts radio wave energy into electromagnetic radio waves that travel outwards at the speed of light.
- Receiver: The operator at the other end of the message may be a few miles away or thousands of miles away. There, another antenna responds to the incoming electromagnetic radio waves by turning them back into radio wave energy. But before this radio wave energy can be understood by people, a receiver must return the energy to the original language or images.
- Transceiver: Originally, the transmitter and receiver were two different pieces of equipment, but modern radios combine both into a single cabinet called a transceiver.

Transmitter + Receiver = Transceiver

### Radio Merit Badge Requirement 5

5a. Explain the differences between a block diagram and a schematic diagram.

- A block diagram is a conceptual outline of a radio or a radio system. It is the electronic equivalent of a business organizational chart.
- A schematic diagram is a map with connecting pathways of the individual components of an electronic device. Like a blueprint of a building, its specific detail would allow construction of the device.

5b. Draw a block diagram for a radio station that includes a *transceiver*, *amplifier*, *microphone*, *antenna*, and *feed line*.



# Requirement Guidelines

## Radio Merit Badge



### Requirement 5, Continued

- Candidates will have done this in the Opening Class. If you ask to see this first, it will serve as a starter for the discussion of 5a.
- 5c. Discuss how information is sent when using amplitude modulation (AM), frequency modulation (FM), continuous wave (CW) Morse Code transmission, single sideband (SSB) transmission, and digital transmission.
- This will be covered in the Opening Class with an oscilloscope demonstration. Candidates should have a sense of the difference between AM and FM modulation. CW “modulation” is easy to understand, but the discussion of single sideband and digital transmission is more technical; focus on AM, FM, and CW.
- 5d. Explain how NOAA Weather Radio (NWR) can alert you to danger.
- This is straight-forward—a public service warning system.
- 5e. Explain how cellular telephones work. Identify their benefits and limitations in an emergency.
- The emphasis here is on the system of low-power transceivers working through a network of tower repeaters, not the modulation nor the electronics.
  - The emergency benefit is portability.
  - Limitations include overloaded capacity, land lines must be functioning, and the power lines must be functioning.

### Radio Merit Badge Requirement 6

Explain the safety precautions for working with radio gear.

(There is no specified number of safety points.)

#### RF Safety

- Keep covers on radios.
- RF can cause burns.
- Eyes are especially sensitive.

#### Radio Safety

- Disconnect power before working on radios.
- Even with power off, radios store energy.

- Disconnect radios when not in use.

#### Antennas and Towers.

- Make sure antennas can't touch power lines.
- Make sure than people/pets can't touch radiating antenna parts.
- Be careful climbing towers.
- Be careful on roofs.

#### Grounding

- AC grounding requires three conductor power cables and three prong plugs.
- DC Grounding requires a ground rod connected to equipment cases.
- Antenna grounding requires a way to bleed off stray electrical charges before feedlines enter a house.

#### Lightning Protection

- Antenna support connected to ground rod(s).
- Disconnect radios when lightning is in area.
- Lightning can travel down feedlines to radio.

#### Electricity Safety

- Only need 0.1 amp at 30 volts across chest to kill.
- Power lines are high voltage and are not insulated.

### Radio Merit Badge Requirement 7

7. Ask whether or not the candidate has visited the radio stations in the stables. If not, ask the candidate to do that first and then come back for the rest of the interview. Once the candidate has had the station experience, proceed with the elements below.

#### Equipment seen in use.

- The candidate's drawing prepared for Requirement 4 will serve as a good framework for this conversation.

The following elements are free-form and not easily defined. Assume that a general conversation will be sufficient.

#### How equipment was used.

#### Types of licenses are required.

- This requirement will be covered specifically in Requirement 9.





# Requirement Guidelines

## Radio Merit Badge



### Requirement 7, Continued

Purpose of the station.

- Use Requirement 1a, the difference between broadcast and hobby radio, as a way of easing this conversation.

### Radio Merit Badge Requirement 8

8. Find out about three career opportunities in radio.

- The requirement does not specify how this is to be demonstrated, but we have asked the candidates to prepare written responses. Ask the candidate if he/she has a written response, but accept an oral reply if not.
- All that is required is that three opportunities be named.

Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

- This requirement is specific and candidates should be able to provide reasonable answers to the education, training, and experience components.
- There is no wrong answer to why this career might appeal.

### Radio Merit Badge Requirement 9a

9a/a. Tell why the FCC has an amateur radio service. Describe activities that amateur radio operators can do on the air, once they have earned an amateur radio license.

- Public service, International goodwill, experimentation, communication skills.
- The most likely answer to this question will be "To talk to people." Also contesting, fox hunting, slow scan TV, moon bounce, back pack portable, home brewing, etc.

9a/b. Explain differences between the Technician, General, and Extra Class license requirements and privileges. Explain who administers amateur radio exams.

- Each progressive license requires more technical knowledge and grants more operating privileges and frequencies.
- Amateur radio exams are administered by radio amateurs known as Volunteer Examiners who are trained and certified for that purpose.

9a/c. Explain at least five Q signals or amateur radio terms.

- The candidate is not required to memorize these signals or terms. You can suggest signals and terms as prompts and ask for an explanation.

9a/d. Explain how you would make an emergency call on voice or Morse code.

- Voice: To clear the frequency, say "Break-Break." Then say "Mayday-Mayday" or, "I have an emergency".
- CW: send S-O-S.

9a/e. Explain the differences between handheld transceivers and home "base" transceivers. Explain the uses of mobile amateur radio transceivers and amateur radio repeaters.

- By virtue of their size and portability, hand-helds are battery-powered low power transceivers. Base stations typically run off line power and are higher power transceivers.
- Anything that takes advantage of mobility will serve as an answer to the uses of mobile amateur radio transceivers.
- Amateur radio repeaters relay the low power signals of hand-helds and mobile stations so that they are able to reach further than they would on their own.
- Repeaters on high ground allow signals to reach over obstructing terrain.

9a/f. Using proper call signs, Q signals, and abbreviations, carry on a 10-minute real or simulated amateur radio contact using voice, Morse code, or digital mode.

- This requirement will be fulfilled at the radio stations. Check to see if it has already been marked and do so if the candidate has been there, but not credited.



# Radio Merit Badge Requirements



## Requirement 1

Explain what radio is. Then discuss the following:

- The differences between broadcast radio and hobby radio.
- The differences between broadcasting and two-way communications.
- Radio station call signs and how they are used in broadcast radio and amateur radio.
- The phonetic alphabet and how it is used to communicate clearly.

## Requirement 2

Do the following:

- Sketch a diagram showing how radio waves travel locally and around the world.
- Explain how the radio stations WWV and WWVH can be used to help determine what you can expect to hear when you listen to a shortwave radio.
- Explain the difference between a distant (DX) and a local station.
- Discuss what the Federal Communications Commission (FCC) does and how it is different from the International Telecommunication Union.

## Requirement 3

Do the following:

- Draw a chart of the electromagnetic spectrum covering 300 kilohertz (kHz) to 3000 megahertz (MHz).
- Label the MF, HF, VHF, UHF, and microwave portions of the spectrum on your diagram.
- Locate on your chart at least eight radio services, such as AM and FM commercial broadcast, citizens band (CB), television, amateur radio (at least four amateur radio bands), and public service (police and fire).

## Requirement 4

Explain how radio waves carry information.

Include in your explanation: transceiver, transmitter, receiver, amplifier, and antenna.

## Requirement 5

Do the following:

- Explain the differences between a block diagram and a schematic diagram.
- Draw a block diagram for a radio station that includes a transceiver, amplifier, microphone, antenna, and feed line.
- Discuss how information is sent when using amplitude modulation (AM), frequency modulation (FM), continuous wave (CW) Morse Code transmission, single sideband (SSB) transmission, and digital transmission.
- Explain how NOAA Weather Radio (NWR) can alert you to danger.
- Explain how cellular telephones work. Identify their benefits and limitations in an emergency.

## Requirement 6

Explain the safety precautions for working with radio gear.

Including the concept of grounding for direct current circuits, power outlets, and antenna systems.

## Requirement 7

Visit a radio installation

An amateur radio station, broadcast station, or public service communications center, for example, approved in advance by your counselor. Discuss what types of equipment you saw in use, how it was used, what types of licenses are required to operate and maintain the equipment, and the purpose of the station.

## Requirement 8

Find out about three career opportunities in radio.

Pick one and find out the education, training, and experience required for this profession.

Discuss this with your counselor, and explain why this profession might interest you.



# *Radio Merit Badge Requirements*



## Requirement 9

### Amateur Radio

- a. Tell why the FCC has an amateur radio service. Describe activities that amateur radio operators can do on the air, once they have earned an amateur radio license.
- b. Explain differences between the Technician, General, and Extra Class license requirements and privileges. Explain who administers amateur radio exams.
- c. Explain at least five Q signals or amateur radio terms.
- d. Explain how you would make an emergency call on voice or Morse code.
- e. Explain the differences between handheld transceivers and home "base" transceivers. Explain the uses of mobile amateur radio transceivers and amateur radio repeaters.
- f. Using proper call signs, Q signals, and abbreviations, carry on a 10-minute real or simulated amateur radio contact using voice, Morse code, or digital mode. (Licensed amateur radio operators may substitute five QSL cards as evidence of contacts with five amateur radio operators. Properly log the real or simulated ham radio contact, and record the signal report.)