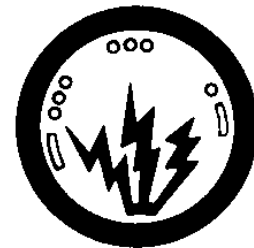




# RADIO

## Merit Badge Requirements



- 1) Explain what radio is. Include in your explanation: the differences between broadcast radio and hobby radio, and the differences between broadcasting and two-way communicating. Also discuss broadcast radio and amateur radio call signs and using phonetics.
- 2) Sketch a diagram showing how radio waves travel locally and around the world. How do the broadcast radio stations, WWV and WWVH, help determine what you will hear when you listen to the radio?
- 3) Do the following:
  - A) Draw a chart of the electromagnetic spectrum covering 100 kilohertz (khz) to 1000 megahertz (Mhz).
  - B) Label the LF, MF, HF, VHF UHF, and microwave portions of the spectrum on your diagram.
  - C) Locate on your chart at least eight radio services such as AM and FM commercial broadcast, CB, television, amateur radio (at least four ham radio bands), and police.
  - D) Discuss why some radio stations are called DX and others are called local. Explain who the FCC and the ITU are.
- 4) Explain how radio waves carry information. Include in your explanation: transceiver, transmitter, amplifier, and antenna.
- 5) Learn the safety precautions for working with radio gear, particularly Dc and Rf grounding.
- 6) Do the following:
  - A) Explain the differences between a block diagram and a schematic diagram.
  - B) Draw a block diagram that includes a transceiver, amplifier, microphone, antenna, and feedline.
  - C) Explain the differences between an open circuit, a closed circuit, and a short circuit.
  - D) Draw ten schematic symbols. Explain what three of the represented parts do. Find three electrical components to match to three of these symbols.
- 7) Do ONE of the following (a, b, or c):
  - A) Amateur radio
    - 1) Describe some of the activities that amateur radio operators can do on the air, once they have earned an amateur radio license.
    - 2) Carry on a 10-minute real or simulated ham radio contact using voice or Morse code; use proper call signs, Q signals, and abbreviations. (Licensed ham radio operators may substitute five QSL cards as evidence of contacts with amateur radio operators from at least three different call districts.)
    - 3) With the help of a local amateur radio operator, talk to and properly log at least two Morse code radio contacts. Record signal reports. Explain how often amateur radio operators must give their call signs during a radio contact.
    - 4) Explain at least five Q signals or amateur radio terms you hear while listening.
    - 5) Explain some differences between the Novice Class license and the Technician Class license requirements and privileges. Explain who gives amateur radio exams.
    - 6) Explain how you would make an emergency call on voice or Morse code. Tell why the FCC has an amateur radio service.
    - 7) Explain handheld transceivers versus home "base" stations. Explain about mobile amateur radios and amateur radio repeaters.
  - B) Broadcast radio
    - 1) Prepare a program schedule for radio station "KBSA" of exactly on-half hour, including music, news, commercials, and proper station identification. Record your program on audio tape using proper techniques.
    - 2) Listen to and properly log fifteen broadcast stations; determine for five of these their transmitting power and general areas served.
    - 3) Explain at least eight terms used in commercial broadcasting such as segue, cut, and fade.
    - 4) Discuss the educational and licensing requirements and career opportunities in broadcast radio.
  - C) Shortwave listening
    - 1) Listen across several shortwave bands for two four-hour periods, one in the early morning, and the other in the early evening. Log the stations properly and locate them geographically on a globe.
    - 2) For several major foreign stations (BBC in Great Britain or HCJB in Ecuador, for example), list several frequency bands used by each.
    - 3) Compare your morning and evening logs, noting the frequencies on which your selected stations were loudest during each session. Explain the differences in signal strength from one period to the next.
    - 4) Discuss the purpose of and careers in shortwave communications.
- 8) Visit a radio installation approved in advance by your counselor (ham radio station, broadcast station, or public service communications center, for example). Discuss what types of equipment you saw in use, how it was used, what types of licenses required to operate and maintain the equipment, and the purpose of the station.

## Requirement 1

Explain what radio is: \_\_\_\_\_

\_\_\_\_\_

What are the differences between broadcast radio and hobby radio? \_\_\_\_\_

\_\_\_\_\_

What are the differences between broadcasting and two-way communicating? \_\_\_\_\_

\_\_\_\_\_

Explain broadcast radio and amateur radio call signs: \_\_\_\_\_

\_\_\_\_\_

Why are phonetics used? \_\_\_\_\_

\_\_\_\_\_

Supply the correct word used to make spelling more clear:

A - Alfa

F -

K -

P -

U -

B -

G -

L -

Q -

V -

C -

H -

M -

R -

W -

D -

I -

N -

S -

X -

E -

J -

O -

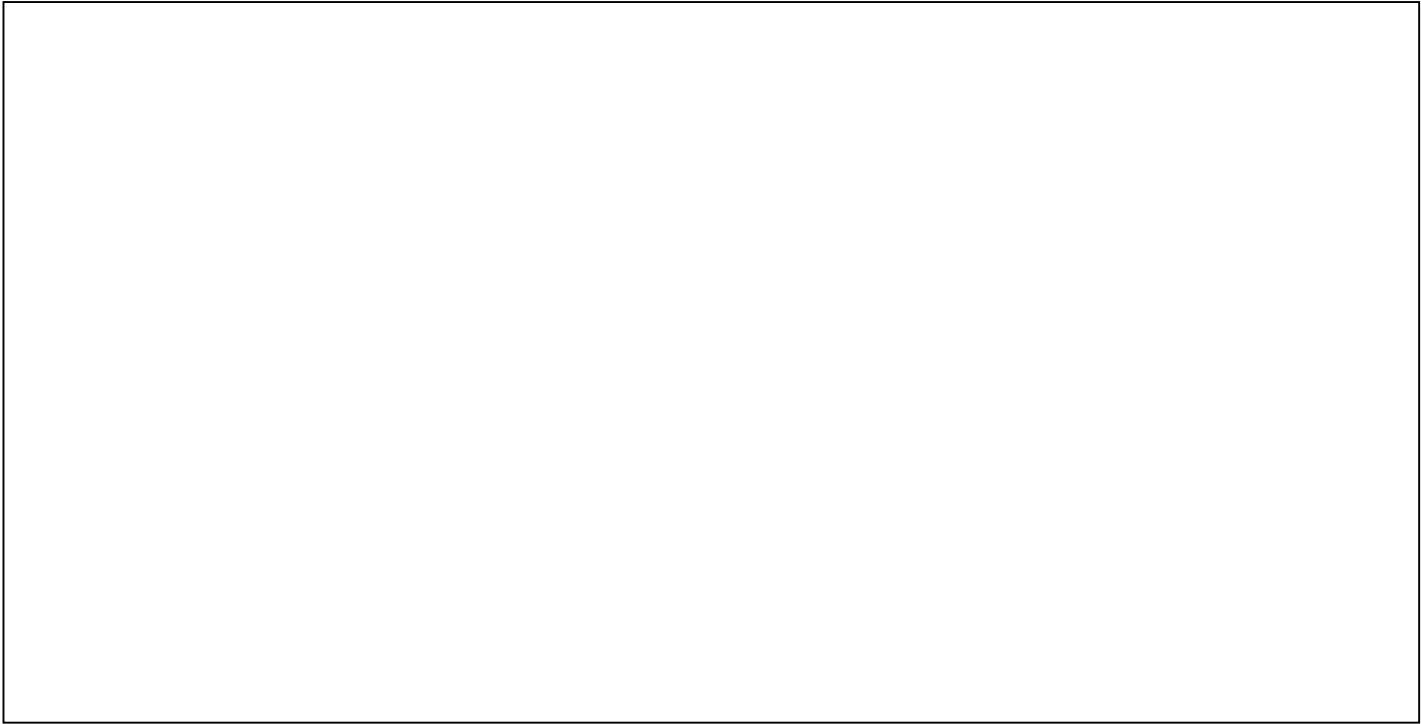
T -

Y -

Z -

## Requirement 2

Use the area below to sketch a diagram showing how radio waves travel locally and around the world.



How do the broadcast radio stations, WWV and WWVH, help determine what you will hear when you listen to a radio? \_\_\_\_\_

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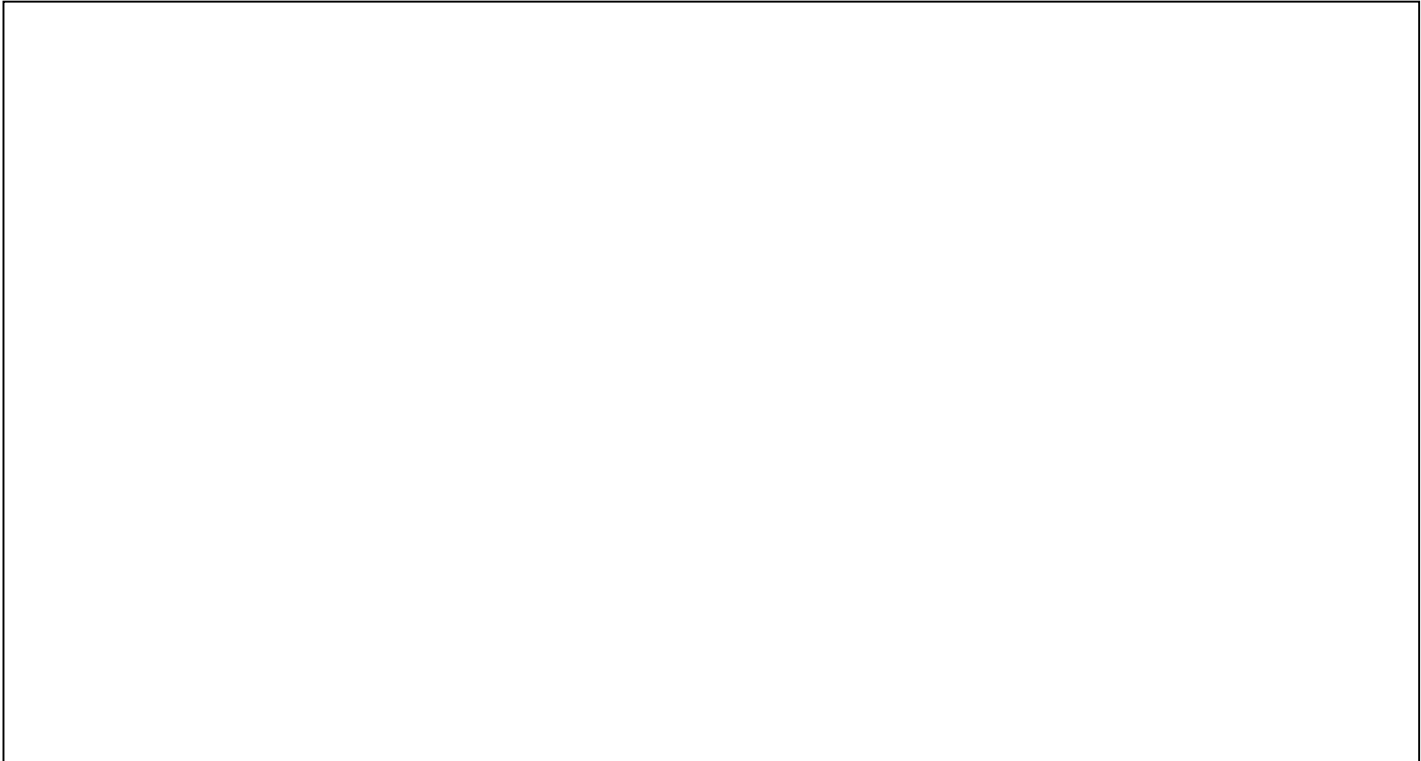
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**Requirement 3**

Use the following area to draw a chart of the electromagnetic spectrum covering 100 kilohertz (khz) to 1000 megahertz (Mhz). For help with this chart, look at the chart example provided in the Radio merit badge pamphlet.





Transceiver: \_\_\_\_\_

Transmitter: \_\_\_\_\_

Amplifier: \_\_\_\_\_

Antenna: \_\_\_\_\_

A definition of these words along with requirement 6b should be sufficient for this requirement. Make sure you get approval from your merit badge counselor first!

**Merit Badge Counselor Signature of Approval:** \_\_\_\_\_

### Requirement 5

*Working on radios can be dangerous not only because they use electricity but also because radio frequencies themselves can cause burns if you touch an antenna when someone is transmitting. PLEASE DO NOT WORK ON ELECTRONIC EQUIPMENT YOURSELF until you have learned from someone more experienced.*

Learn the safety precautions for working with radio gear, particularly Dc and Rf grounding. Briefly list the safety code items listed by in the ARRL Safety Code:

1: \_\_\_\_\_

2: \_\_\_\_\_

3: \_\_\_\_\_

4: \_\_\_\_\_

5: \_\_\_\_\_

6: \_\_\_\_\_

7: \_\_\_\_\_

8: \_\_\_\_\_

9: \_\_\_\_\_

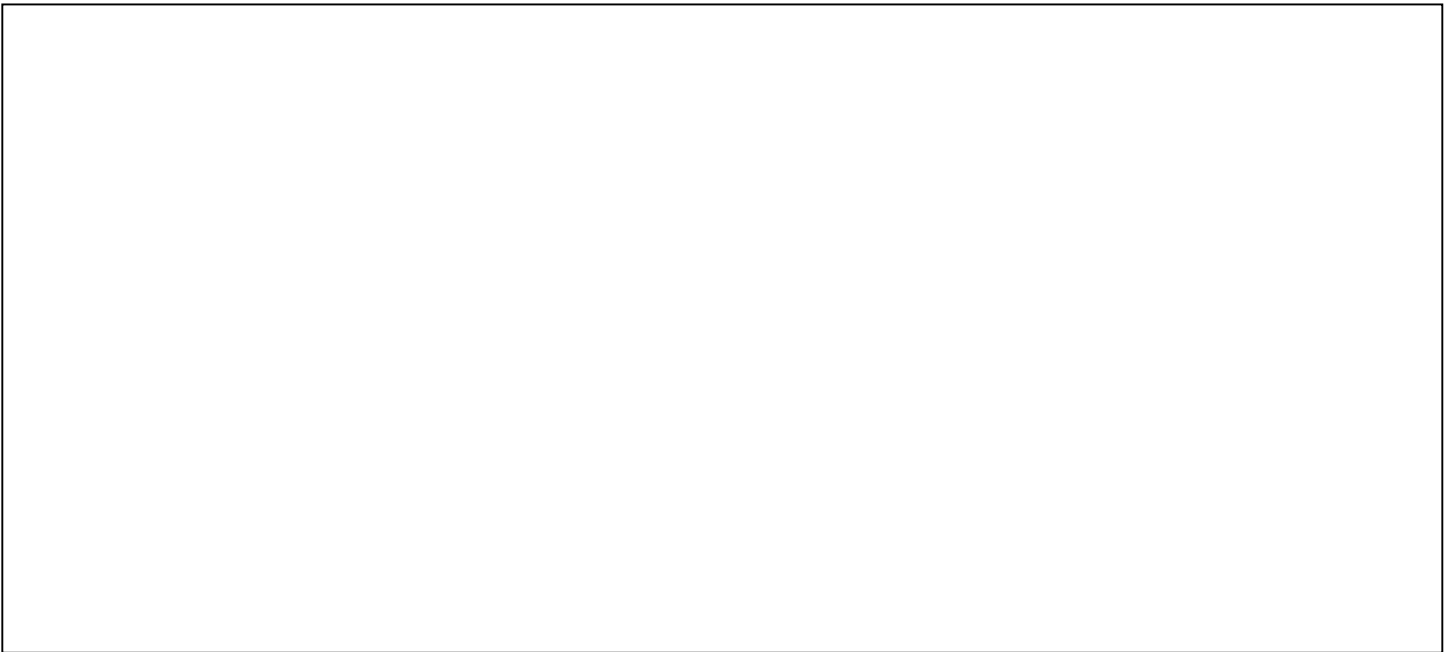
Here are some other safety precautions you will want to be mindful of:

- Electrical shock can hurt or kill you. Make sure the power is disconnected before working.
- Even with the power off, some parts inside the radio can hold a dangerous charge. If you don't know for sure what you are doing, get help.
- Radio Frequency (RF) can burn you badly. Keep antennas out of reach of people and animals.
- RF radiation can be unhealthy. Don't use a radio when it is not completely assembled. The case keeps the RF radiation in.
- Make sure the antennas can't touch any power lines or you could be electrocuted when using the radio.
- Lightning can hit your antenna and travel down your lines to the radio. Make sure your antenna and radio are grounded to a good earth ground.
- Be careful working on towers and roofs so you don't fall or hurt someone on the ground

### Requirement 6

Explain the difference between a block diagram and a schematic diagram: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

In the area below to draw a block diagram that includes a transceiver, amplifier, microphone, antenna, and feedline:



Explain the differences between an open circuit, a closed circuit, and a short circuit: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Use this area to draw ten schematic symbols.

Select three of the ten symbols that you drew and explain what the represented parts do:

Symbol / Part: \_\_\_\_\_ What does it do? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Symbol / Part: \_\_\_\_\_ What does it do? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Symbol / Part: \_\_\_\_\_ What does it do? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Find three electrical components to match to three of the symbols you provided. List the three you found:

\_\_\_\_\_

**Requirement 7**

You have been given three options to select from for this requirement; Amateur Radio, Broadcast Radio, and Shortwave listening. Select one of the options and complete the requirements listed under that specific option.

If you selected *Option A - Amateur Radio*:

Describe some of the activities that amateur radio operators can do on the air, once they have earned an amateur radio license: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Carry on a 10-minute real or simulated ham radio contact using voice or Morse code; use proper call signs, Q signals, and abbreviations. Give a short summary of your conversation and list some of the call signs, Q signals, and abbreviations that you used:



Station Worked: \_\_\_\_\_ Report Sent: \_\_\_\_\_ Report Received: \_\_\_\_\_

Time Off: \_\_\_\_\_ Radio Signal Report: \_\_\_\_\_ QTH: \_\_\_\_\_ Name: \_\_\_\_\_

Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain how often amateur radio operators must give their call signs during a radio contact and why: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Explain at least five Q signals or amateur radio terms you hear while listening:

Signal or Term: _____	Meaning: _____
Signal or Term: _____	Meaning: _____
Signal or Term: _____	Meaning: _____
Signal or Term: _____	Meaning: _____
Signal or Term: _____	Meaning: _____

*\*Before completing the next step, read about the new FCC license requirements below and discuss with your counselor the way they would like for you to complete this part of the requirement.*

Explain some differences between the Novice Class license and the Technician Class license requirements and privileges:

Novice license: \_\_\_\_\_  
\_\_\_\_\_

Technician license: \_\_\_\_\_  
\_\_\_\_\_

Tech-Plus license: *Do both. Most start with the Technician license and then learn Morse code to get this license.*

**NEW LICENSE REQUIREMENTS**

*\*Not yet reflected in most current merit badge pamphlets*

**Starting April 15, 2000, there are only three license classes. There is no longer a Novice license class. The 3 license classes are:**

**Technician:** One 35 question multiple choice test and no Morse code requirement. Gives full VHF & UHF use so you can communicate around town and use repeaters, but you cannot use some of the HF bands which are used for world-wide contacts.

**General:** A second 35 question multiple choice test and requires 5 WPM Morse code. Gives all rights of the Technician license plus HF use for world-wide contacts.

**Extra:** A third 50 question multiple choice test and now requires only a 5 WPM Morse code test. Gives access to ALL the ham radio bands.

Who gives amateur radio exams? \_\_\_\_\_

Explain how you would make an emergency call on voice or Morse code: \_\_\_\_\_

Tell why the FCC has an amateur radio service: \_\_\_\_\_

Explain handheld transceivers versus home "base" stations: \_\_\_\_\_

Explain about mobile amateur radios and amateur radio repeaters: \_\_\_\_\_

If you selected **Option B - Broadcast Radio**:

Prepare a program schedule for radio station "KBSA" of exactly one-half hour, including music, news, commercials, and proper station identification. You can use the area below to help you schedule, minute-by-minute, your half-hour radio program or you can create you own layout and attach it to this worksheet. Show your schedule to your counselor before recording it.

To use this graph, let each line represent one minute. Use shading to help identify items lasting longer than one minute. See the example below for ideas.

Minute	Item Description
1	Station Identification - "KBSA"
2	Commercial - Local Auto Dealer Inventory Blow-Out Sale
3	
4	Local Weather - Stormy Jones gives live forecast for this week
5	Spotlight News Story - Local Boy Scout Troop Participates in Jamboree On The Air
6	

### KBSA - Program Schedule

Minute	Item Description & Detail
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	

15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	

\_\_ Record your program on audio tape using proper techniques. Turn your recording in to your counselor for review.

Listen to and log fifteen broadcast stations. Use the area below to log each station. For five of the stations on the list, determine the transmitting power and general areas served. Use the first five records below to log these stations.

Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_  
Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*Transmitting Power: \_\_\_\_\_ General Areas Served: \_\_\_\_\_

Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_  
Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*Transmitting Power: \_\_\_\_\_ General Areas Served: \_\_\_\_\_

Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_  
Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*Transmitting Power: \_\_\_\_\_ General Areas Served: \_\_\_\_\_

Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_  
Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\*Transmitting Power: \_\_\_\_\_ General Areas Served: \_\_\_\_\_

Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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\*Transmitting Power: \_\_\_\_\_ General Areas Served: \_\_\_\_\_

Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_

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Explain at least eight terms used in commercial broadcasting, such as segue, cut, and fade.

Term: \_\_\_\_\_ Definition: \_\_\_\_\_

Term: \_\_\_\_\_ Definition: \_\_\_\_\_

Term: \_\_\_\_\_ Definition: \_\_\_\_\_

Term: \_\_\_\_\_ Definition: \_\_\_\_\_

Term: \_\_\_\_\_ Definition: \_\_\_\_\_

Term: \_\_\_\_\_ Definition: \_\_\_\_\_

Term: \_\_\_\_\_ Definition: \_\_\_\_\_

Term: \_\_\_\_\_ Definition: \_\_\_\_\_

What are some of the educational requirements for broadcast radio? \_\_\_\_\_

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What are some of the licensing requirements for broadcast radio? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Discuss some of the career opportunities in broadcast radio: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

If you selected **Option C - Shortwave Listening**:

Listen across several shortwave bands for two four-hour periods, one in the early morning, the other in the early evening. Log the stations and locate them geographically on the globe.

**Early Morning - 4 Hours**

Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Transmitting Power: \_\_\_\_\_ General Areas Served: \_\_\_\_\_

**Early Evening - 4 Hours**

Frequency: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_ Station ID: \_\_\_\_\_ Location: \_\_\_\_\_

Emission Mode: \_\_\_\_\_ Signal Quality: \_\_\_\_\_ Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Transmitting Power: \_\_\_\_\_ General Areas Served: \_\_\_\_\_

For several major foreign stations (BBC in Great Britain or HCJB in Ecuador, for example), list several frequency bands used by each.

Foreign Station: \_\_\_\_\_ Frequency Bands Used: \_\_\_\_\_

Foreign Station: \_\_\_\_\_ Frequency Bands Used: \_\_\_\_\_

Foreign Station: \_\_\_\_\_ Frequency Bands Used: \_\_\_\_\_

Foreign Station: \_\_\_\_\_ Frequency Bands Used: \_\_\_\_\_

Foreign Station: \_\_\_\_\_ Frequency Bands Used: \_\_\_\_\_

Foreign Station: \_\_\_\_\_ Frequency Bands Used: \_\_\_\_\_

Foreign Station: \_\_\_\_\_ Frequency Bands Used: \_\_\_\_\_

Compare your morning and evening logs, noting the frequencies on which your signal strength from one period to the next. Explain what you found: \_\_\_\_\_

What is the purpose of shortwave communications? \_\_\_\_\_

List some of the careers in shortwave communications? \_\_\_\_\_

### **Requirement 8**

Visit a radio installation approved in advance by your counselor (ham radio station, broadcast station, or public service communications center, for example).

What radio installation did you visit and what kind was it? \_\_\_\_\_

What types of equipment did you see in use and how was it being used? \_\_\_\_\_

What types of licenses are required to operate and maintain the equipment that you saw? \_\_\_\_\_

Describe the purpose of the station: \_\_\_\_\_

Give a general summary of your visit to the station: \_\_\_\_\_

