

Radio

Merit Badge Workbook



Merit badges are earned by doing: reading the pamphlet, practicing the skills, and showing your counselor what you have learned.
This workbook gives you a place to organize your notes and track your progress along the way.
Merit badge counselors may not require the use of this or any similar workbook.
You still must satisfy your counselor that you can demonstrate each skill and have learned the information.
Use the space under each requirement to note what you have done and what you want to talk about, not to write out full answers.
When a requirement says discuss, show, tell, explain, or demonstrate, that is what you must do.
No one may add to or subtract from the official requirements found on scouting.org (Guide to Advancement 7.0.4.8).
Scouting America last updated this badge's requirements page on December 31, 2025.
Requirements change from time to time. Double-check scouting.org before you start.

Scout's name: _____ Unit: _____ Date started: _____

Counselor's name: _____ Phone no.: _____ Email: _____

Links marked "Scouting America resources" are the ones Scouting America shares on its official badge page.
This workbook is unofficial and not endorsed by Scouting America.

---

1. Radio Safety. Explain the safety precautions for working with radio gear, including:

(a) Grounding for direct and alternating current circuits, power outlets, antennas, and lightning

Scouting America resources: Grounding Explained (video) · What Is Ground? (video)

Grounding safety

Grounding for	Safety precautions
direct current circuits	
alternating current circuits	
power outlets	
antennas	
lightning	

(b) Preventing and treating electrical burns

Scouting America resources: First Aid for Electrical Burns (website) · Rescue and First Aid for Electric Shock (video)

Electrical burns

	What I would do
Preventing	
Treating	

(c) Preventing lithium-ion battery fires in cell phones and other devices

Scouting America resources: Preventing Lithium Ion Battery Fires (video)

How to prevent lithium-ion battery fires in phones and other devices

Requirement 1 completed on _____ counselor initials _____

2. Radio Fundamentals. Do the following:

(a) Do the following:

(1) Draw a chart of the electromagnetic spectrum covering 300 kilohertz (kHz) to 3,000 megahertz (MHz).
Scouting America resources: Frequency Bands (video)

My chart of the spectrum from 300 kHz to 3,000 MHz (draw here or attach)

(2) Label the MF, HF, VHF, UHF, and microwave portions of the spectrum on your diagram.
Scouting America resources: Radio Frequency Bands (video)

- ☐ MF
- ☐ HF
- ☐ VHF
- ☐ UHF
- ☐ microwave

(3) 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), public service (police and fire), cellular, Wi-Fi, and Bluetooth.
Scouting America resources: Common Uses of Ham Radio Frequencies (video)

Radio services I located on my chart

Radio service	Where it is on the spectrum
1	
2	
3	
4	
5	
6	
7	
8	

(b) Discuss the following topics with your counselor:

(1) The definition of radio
Scouting America resources: Communication and Radio (video) · What Is a Radio Wave? (video)

(2) The differences between broadcast radio and two-way radio

Scouting America resources: How Broadcast Radio Works (video)
Two-Way Radios Explained: VHF vs UHF, FCC Licenses, and More FAQs (video)

(3) The differences between commercial broadcast radio and hobby radio

Scouting America resources: What Is Ham Radio? How Amateur Radio Works (No Internet Required) (video)

Requirement 2 completed on _____ counselor initials _____

3. How Radio Waves Travel. Do the following:

(a) Sketch a diagram showing how different radio wavelengths can travel locally or around the world.

Scouting America resources: What Is Propagation? (video) · Why Some AM Radio Stations Don't Work at Night (video)

My diagram of how radio waves travel locally and around the world (sketch here or attach)

(b) 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.

Scouting America resources: WWV WWVH Time Signals (video)

How WWV and WWVH help me know what to expect on shortwave

(c) Explain the difference between a distant (DX) and a local station.

Scouting America resources: DXing: D for Distance, X for Unknown (video) · Ham Radio DX Fun (video)

Station	What it is
Distant (DX)	
Local	

Requirement 3 completed on _____ counselor initials _____

4. Information by Radio. Discuss the following with your counselor:

(a) How radio waves carry information using continuous wave (CW) Morse Code transmission, amplitude modulation (AM), frequency modulation (FM), single sideband (SSB) transmission, and frequency hopping.

Scouting America resources: Radio Wave Modulation (video) · Frequency Hopping (video) · Frequency Hopping and WiFi (video)

How radio waves carry information

Method	How it works
continuous wave (CW) Morse Code transmission	
amplitude modulation (AM)	
frequency modulation (FM)	
single sideband (SSB) transmission	
frequency hopping	

(b) How digitized radio standards including Bluetooth, Wi-Fi, and 5G can offer more reliable data transmission and reception than analog standards.

Scouting America resources: Analog vs Digital Data (video) · Digital vs Analog. What's the Difference? Why Does It Matter? (video) Analog vs Digital Radio: A Beginner's Guide to Radio Modes (video)

Why digital standards can be more reliable than analog

(c) How the effective range varies for different methods of information encoding.

Scouting America resources: Relationship Between Frequency, Data Rate, and Distance (video) How Radio Waves Transmit Information (video)

How the effective range changes with the encoding method

(d) How the maximum data rate from a Wi-Fi radio system compares to a hard-wired or fiber-optic system.

Scouting America resources: Ethernet vs WiFi, Which One Is Faster? (video) · Shattering Limits: 402 Terabits per Second (video)

Comparing data rates

System	Maximum data rate	Notes
Wi-Fi radio		
Hard-wired		
Fiber-optic		

Requirement 4 completed on _____ counselor initials _____

5. Radio Hardware and Services. Do the following:

(a) Explain the differences between a block diagram and a schematic diagram.

Scouting America resources: How To Read a Schematic (video)

Diagram	What it shows
Block diagram	
Schematic diagram	

(b) Draw a block diagram for a radio station that shows a microphone, speaker, transceiver, transmitter, receiver, amplifier, feedline, and antenna and discuss the function of these components.

My block diagram of a radio station (draw here or attach)

What each component does

Component	Its function
microphone	
speaker	
transceiver	
transmitter	
receiver	
amplifier	
feedline	
antenna	

(c) List consumer devices and services that use analog or digital radio communications.

Scouting America resources: Analog vs Digital Radio: A Beginner's Guide to Radio Modes (video)

Consumer devices and services that use radio

Device or service	Analog or digital

(d) Explain how NOAA Weather Radio (NWR) can alert you to danger.

Scouting America resources: National Weather Service: Weather Warning Process (video) · Ways To Get Warnings (video)

How NOAA Weather Radio alerts me to danger

(e) Explain how RFID works and what are some of its uses in everyday life.

Scouting America resources: What Is RFID Technology? And How It Works? (video)
What is RFID (Radio Frequency Identification)? (video)

How RFID works

Uses of RFID in everyday life

Requirement 5 completed on _____ counselor initials _____

6. Radio Regulation. Discuss the following with your counselor:

(a) What the Federal Communications Commission (FCC) does and how it is different from the International Telecommunication Union (ITU).

Scouting America resources: What Is the FCC? (video)

Organization	What it does
Federal Communications Commission (FCC)	
International Telecommunication Union (ITU)	

How they are different

(b) How radio station call signs are used in broadcast radio and amateur radio.

Scouting America resources: Ham Radio Call Signs (video) · Ham 101 Episode 7: Your Call Sign (video)
Broadcast Call Signs Explained (video) · When To ID With Your Call Sign (video)

Where	How call signs are used
Broadcast radio	
Amateur radio	

(c) How the phonetic alphabet is used to communicate clearly.

Scouting America resources: Learn the Phonetic Alphabet (video)

How the phonetic alphabet helps us communicate clearly

Requirement 6 completed on _____ counselor initials _____

7. Cell Phones. Do the following:

(a) Explain how cellular systems differ from broadcast and hobby radio.

Scouting America resources: How Your Mobile Phone Works (video)

How cellular systems differ from broadcast and hobby radio

(b) Explain what Airplane Mode is and why it is important.

Scouting America resources: What Really Happens When You Turn On Airplane Mode (video)
What Happens if You Don't Put Your Phone in Airplane Mode? (video)

What Airplane Mode is, and why it matters

(c) Explain how cell phones keep the correct time and show locations and elevations.

Scouting America resources: How GPS Works Today (video) · GPS, How Does It Work? (video)

How my phone knows

What the phone shows	How it does it
Correct time	
Location	
Elevation	

(d) Explain the benefits and limitations of cell phones in emergencies.

Scouting America resources: How Reliable Are Cell Phones in an Emergency? (video)
When Cell Phones Fail: Staying Connected When It Matters Most (video) · We Tested the iPhone 14's Emergency SOS via Satellite (video)
Does Your Phone Have a Crash Detection Feature? (website)

Cell phones in emergencies

Benefits	Limitations

(e) Explain wireless charging for cell phones and other devices.

Scouting America resources: How Do Wireless Phone Chargers Work? (video) · How Your Phone Charges Through Thin Air (video)

How wireless charging works

Requirement 7 completed on _____ counselor initials _____

8. Amateur and Professional Radio. Do ONE of the following options:

☐ **Option A—Amateur Radio. Do ALL of the following:**

(1) 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.

Scouting America resources: Why Do They Call It Ham Radio? (video)
Episode 3: How To Get a Ham Radio License | Bcu Freshman Class (video)

Why the FCC has an amateur radio service

Activities licensed amateur radio operators can do on the air

(2) Explain differences between the Technician, General, and Extra Class license requirements and privileges. Explain who administers amateur radio exams.

Scouting America resources: Ham Radio License Levels (video)

Amateur radio license classes

License class	Requirements	Privileges
Technician		
General		
Extra Class		

Who administers amateur radio exams

(3) Explain at least five Q signals or amateur radio terms.

Scouting America resources: Q-Codes, Logs, and QRZ.com (video) · Q-Codes and Calling CQ (video)

Q signals and amateur radio terms

Q signal or term	What it means

(4) Explain how you would make an emergency call on voice or Morse code.

Scouting America resources: How To Use Your VHF Marine Radio To Call for Help in a Boat Emergency (video)
Ham Radio Disaster Messaging Demo (video) · Using Ham Radio To Call for Help in an Emergency—What You Should Do! (video)

How I would make an emergency call on voice or Morse code

(5) Explain the differences between handheld, mobile, and base station transceivers and their uses. Explain the use of amateur radio repeaters.

Scouting America resources: How Do Repeaters Work? (video)

Transceiver	How it is different	Its uses
Handheld		
Mobile		
Base station		

How amateur radio repeaters are used

(6) 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. Properly log the real or simulated amateur radio contact, and record the signal report. Note: Licensed amateur radio operators may substitute five QSL cards as evidence of contacts with five amateur radio operators.

Real or simulated _____ Start time _____ End time _____

My contact log

Date	Time	Call sign	Frequency	Mode	Signal report

Q signals and abbreviations I used

☐ **Option B—Radio Broadcasting. Do ALL of the following:**

(1) Discuss with your counselor FCC broadcast regulations. Include power levels, frequencies, and the regulations for low-power stations.

Scouting America resources: How To Start a FM Radio Station! (video)
In Historic Victory for Community Radio, FCC Puts 1,000 Low-Power FM Frequencies Up for Grabs (video)

Topic	What I learned about FCC broadcast regulations
Power levels	
Frequencies	
Regulations for low-power stations	

(2) Prepare a program schedule for radio station "KBSA" of exactly one-half hour, including music, news, commercials, and proper station identification. Record your program on audiotape or in a digital audio format, using proper techniques.

Scouting America resources: Build the Best Programming for Your Radio Station! (video)

☐ Music
☐ News
☐ Commercials
☐ Proper station identification

My program schedule for KBSA (exactly one-half hour)

Start time	Segment	Length

My program schedule for KBSA (exactly one-half hour) (continued)

Start time	Segment	Length

Date recorded | Audio format I used

(3) Listen to and properly log 15 broadcast stations. Determine the program format and target audience for five of these stations.

Scouting America resources: Radio Stations Over The World (video)

My log of 15 broadcast stations

Date	Time	Station	Frequency	Location

Program format and target audience for five of these stations

Station	Program format	Target audience

(4) Explain to your counselor at least eight terms used in commercial broadcasting, such as segue, cut, fade, continuity, remote, Emergency Alert System, network, cue, dead air, PSA, and playlist.

Scouting America resources: Radio Broadcasting Glossary (website)

Commercial broadcasting terms

Term	What it means

(5) Discuss with your counselor alternative radio platforms such as internet streaming, satellite radio, and podcasts.

Scouting America resources: Shortwave Radio Top Ten Tips for Beginners Listen to Online Receivers (video)

Platform	What I learned
Internet streaming	
Satellite radio	
Podcasts	

☐ **Option C—Shortwave and Medium-Wave Listening. Do ALL of the following:**

(1) Listen across several shortwave bands for four one-hour periods-at least one period during daylight hours and at least one period at night. Log the stations properly and locate them geographically on a map, globe, or web-based mapping service.

Scouting America resources: Unlock Shortwave Listening: Fun With HF Ham Radios (video)
Incredible Shortwave Radio Stations Listing (video)

My shortwave listening periods

Period	Date	Start time	Daylight or night	Bands I listened to
1				
2				
3				
4				

My shortwave station log

Period	Time	Frequency	Station	Where it is

Map, globe, or web service I used

(2) Listen to several medium-wave stations for two one-hour periods, one period during daylight hours and one period at night. Log the stations properly and locate them on a map, globe, or web-based mapping service.

Scouting America resources: Great Mediumwave AM radio DXers resource for Finding Stations MWLIST (video)

My medium-wave listening periods

Period	Date	Start time	End time
Daylight			
Night			

My medium-wave station log

Period	Time	Frequency	Station	Where it is

Map, globe, or web service I used

(3) Compare your daytime and nighttime logs; note the frequencies on which your selected stations were loudest during each session. Explain differences in the signal strength from one period to the next.

Scouting America resources: Shortwave for Beginners Day and Night Differences in Radio Propagation of Signals (video)
Understanding Daytime and Night Time Patterns To Increase Shortwave Listening Pleasure (video)
Shortwave Propagation 101 Part 1 Daytime and Nighttime Propagation (video)

Session	Frequencies where my stations were loudest
Daytime	
Nighttime	

Why the signal strength changed from one period to the next

(4) Compare your medium-wave broadcast station logs and explain why some distant stations are heard at your location only during the night.

Scouting America resources: Why AM Radio Signals Propogate Farther At Night Than During the Day (video)
Ground Wave Propagation / Types of Radio Waves (video)

What I noticed comparing my medium-wave logs

Why some distant stations are heard here only at night

(5) Demonstrate listening to a radio broadcast using a smartphone/cell phone. Include international broadcasts in your demonstration.

Scouting America resources: How To Listen to FM Radio on Android or iPhone! (video)
Unlock the Hidden FM Radio in Your Android Smart Phone (video)

Date App or station I used International broadcast

☐ **Option D—Amateur Radio Direction Finding. Do ALL of the following:**

(1) Describe amateur radio direction finding and explain why direction finding is important as both an activity and in competition.

Scouting America resources: Amateur Radio Foxhunting: Equipment, Techniques, & Getting Started—Ham Radio Transmitter Hunting (video) · Radio Direction Finding: AKA How "They" Can Find You (video)

What amateur radio direction finding is

	Why direction finding is important
As an activity	
In competition	

(2) Describe what frequencies and equipment are used for ARDF or fox hunting.

Scouting America resources: Ham Radio Fox Hunting 101 (video)

	What is used for ARDF or fox hunting
Frequencies	
Equipment	

(3) Build a simple directional antenna for either of the two frequencies used in ARDF.

Scouting America resources: Two Simple Ham Radio Antennas You Can Use for Fox Hunting (video)

Date built _____ Frequency it is for _____ Type of antenna _____

How I built it

(4) Participate in a simple fox hunt using your antenna along with a provided receiver.

Scouting America resources: Ham Radio Fox Hunt? (video)

Date _____ Where _____ With whom _____

How the fox hunt went

(5) Show, on a map, how you located the "fox" using your receiver.

My map showing how I located the fox (draw here or attach)

☐ **Option E—Family Radio Service (FRS) and General Mobile Radio Service (GMRS) Walkie Talkies. Do ALL of the following:**

(1) Explain what the Family Radio Service (FRS) and General Mobile Radio Service (GMRS) are and how they are different from each other, from other commercial two-way radios, and from Citizens Band (CB) and amateur radio (ham).

Scouting America resources: FRS VS GMRS: A Radio Service Comparison Guide (video)

My explanation	
What FRS is	
What GMRS is	
How FRS and GMRS differ from each other	
How they differ from other commercial two-way radios	
How they differ from Citizens Band (CB)	
How they differ from amateur radio (ham)	

(2) Explain each of the following for using a FRS radio or GMRS walkie talkie:

(a) Is any type of license needed to use these radios? If so: what kind?

Scouting America resources: Walkie Talkies—FRS vs GMRS vs Ham (video)

(b) What radio frequencies are used and how is information encoded?

Scouting America resources: Troubleshooting Radio Connections (video)

(c) How much power can be used when transmitting?

Scouting America resources: FRS vs. GMRS (video)

(d) What type of antenna can be used?

Scouting America resources: Differences between GMRS and FRS (video)

(e) What is the effective range and what limits it?

(f) What are common everyday uses for these radios?

(g) How can these radios be useful in an emergency?

Scouting America resources: HAM and GMRS Radios for Emergencies (video)
FRS and GMRS Radio for Emergency Communications (video) · The Vital Role of Ham Radio in Disaster Preparedness (video)

(3) Use the FRS radios or GMRS walkie talkies with family, friends, or Scouts on a hike, at an event, or in a team game. Discuss what you learned with your counselor.

Date _____ Hike, event, or game _____ Used with _____

What I learned

Requirement 8 completed on _____ counselor initials _____

9. Careers. Do ONE of the following:

☐ **(a)** Explore careers related to radio. Research one career to learn about the training and education needed, costs, job prospects, salary, job duties, and advancement. With permission of your parent or guardian, your research methods may include an internet or library search, an interview with a professional in the field, or a visit to a location where people in this career work or train. Discuss your findings and career interest with your counselor.

Scouting America resources: How I Got That Job: Public Radio (video)
Broadcast Announcers and Radio Disc Jockeys Careers (video)

Career I researched _____ How I researched it _____

What I found out

Topic	What I found
Training and education needed	
Costs	
Job prospects	
Salary	
Job duties	
Advancement	

My interest in this career

☐ **(b)** Explore how you could use radio knowledge and skills to develop a hobby or to serve as a volunteer. If possible, with permission of your parent or guardian, interview a radio hobbyist or volunteer. Research training and licensing needed, expenses, and organizations that promote or support your objectives. Discuss with your counselor what short-term and long-term goals you might have if you pursue this.

Scouting America resources: (Hobbies) Ham Radio (video) · 5 MOST POPULAR Ham Radio Hobbies (video)

Hobby or volunteer role _____ Person I interviewed (if possible) _____

What I found out

Topic	What I found
Training and licensing needed	
Expenses	
Organizations that support it	

My goals if I pursue this

	Goals
Short-term	
Long-term	

Requirement 9 completed on _____ counselor initials _____

Counselor sign-off

Your counselor signs your blue card or approves the badge in Scoutbook, and your unit records it. This line is for your own records.

Counselor's signature _____ Date completed _____

Official Scouting America resources

Scouting America resources: Radio merit badge page (requirements and resources) · Radio merit badge pamphlet (free PDF)
All merit badges

Made by Cole at ScoutSmarts.com, an Eagle Scout who loves helping Scouts.
Spot an error or a requirement change? Tell me at scoutsmarts.com/contact.
Requirement text © Scouting America. Workbook layout © 2026 ScoutSmarts.com, free to copy for Scouting use.