

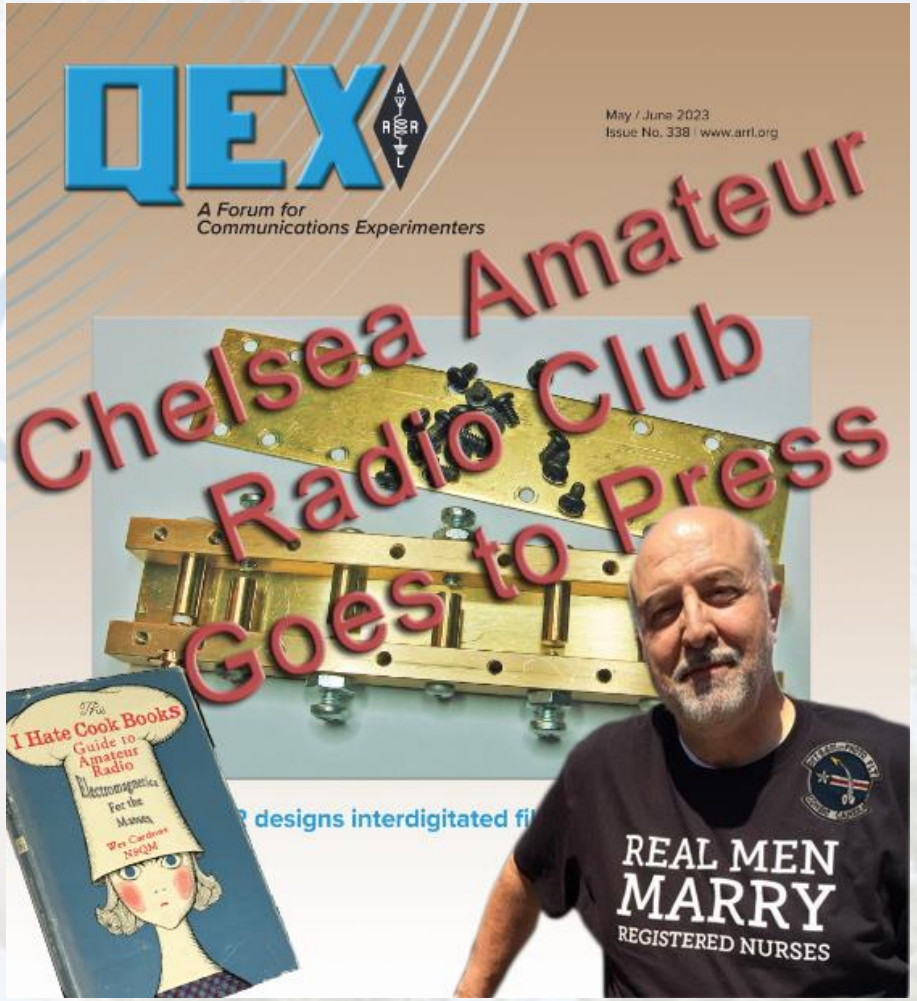
What Do You Need to Know?

Wesley Cardone, N8QM

Trustee Chelsea Repeater, WD8IEL

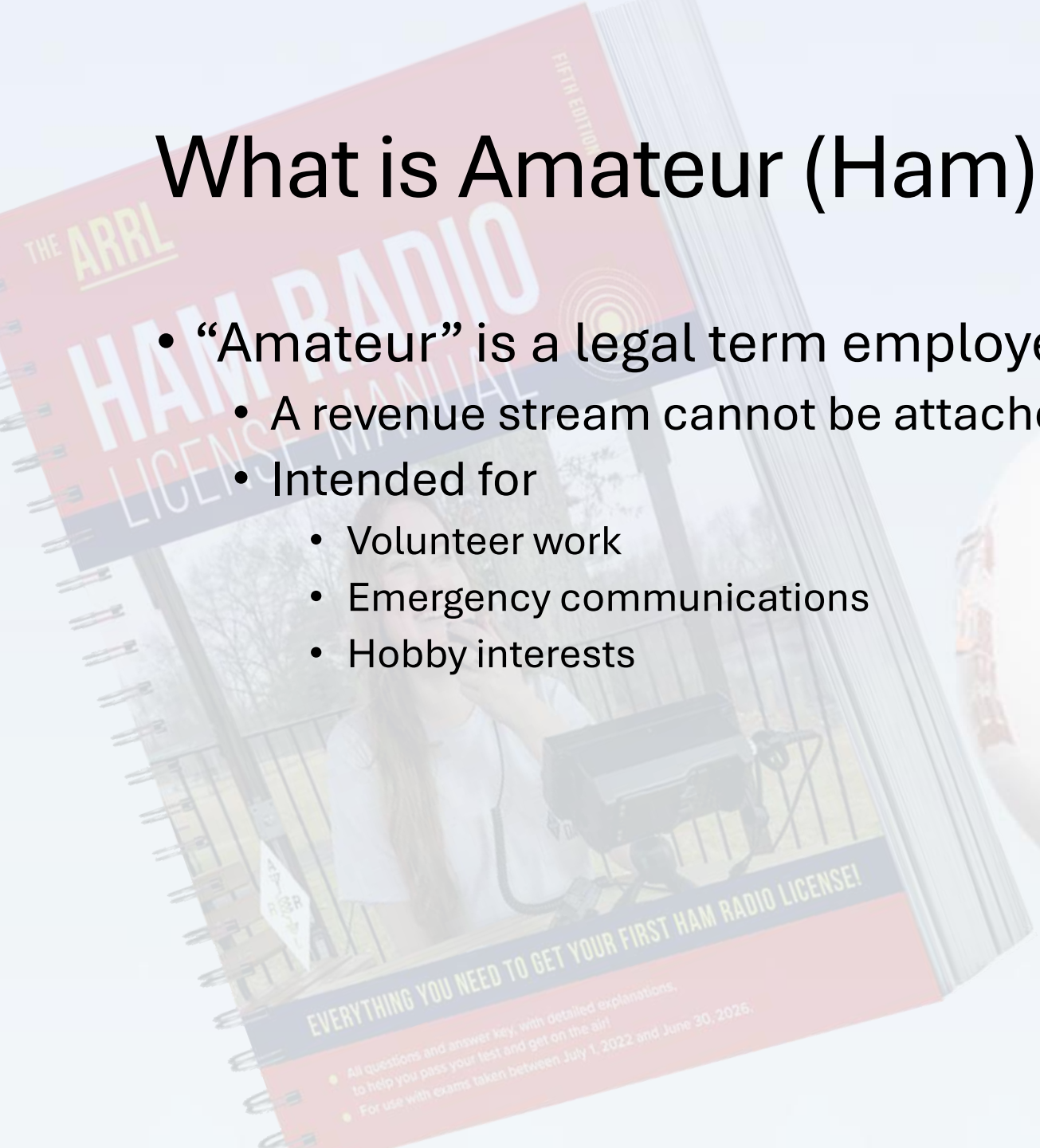
Wesley Cardone, N8QM

- Amateur Radio Licensed since 2019
- BSEE, Cal Poly, 1980
- Electrical Engineer by profession
  - Boeing
    - Re-entry systems
    - B1-B Avionics
  - Johns Hopkins Applied Physics Laboratory
  - Ford Motor
  - Chrysler
- Trustee Chelsea Repeater, WD8IEL



What is Amateur (Ham) Radio

- “Amateur” is a legal term employed by the FCC in 1934.
  - A revenue stream cannot be attached to Amateur Radio.
  - Intended for
    - Volunteer work
    - Emergency communications
    - Hobby interests



How I Started in Ham Radio

- Was always fascinated as a child.
- Never thought to tell mom & dad.
- An electrical engineer professionally
- Through 30 years of engineering, my brother-inlaw kept reminding me about amateur radio.
- On September 14, 2019 I took the plunge obtaining Technician.
- Returned to test two weeks later for the General and Extra classes.
- Served as vice-president of the Jackson club from 2020 through 2021.
- Accepted Trusteeship of the Chelsea repeater in 2022.

Why Should I Get Licensed

- You need to know the “rules of the road.”
- License is good for 10 years.
- Age Requirements: If you can read you can be licensed.
- Promotes STEM education for youth.
  - Get expert technical consultation
- When all else fails, Ham Radio is still there with a global presence.



Levels of Ham Radio Licensed by the FCC

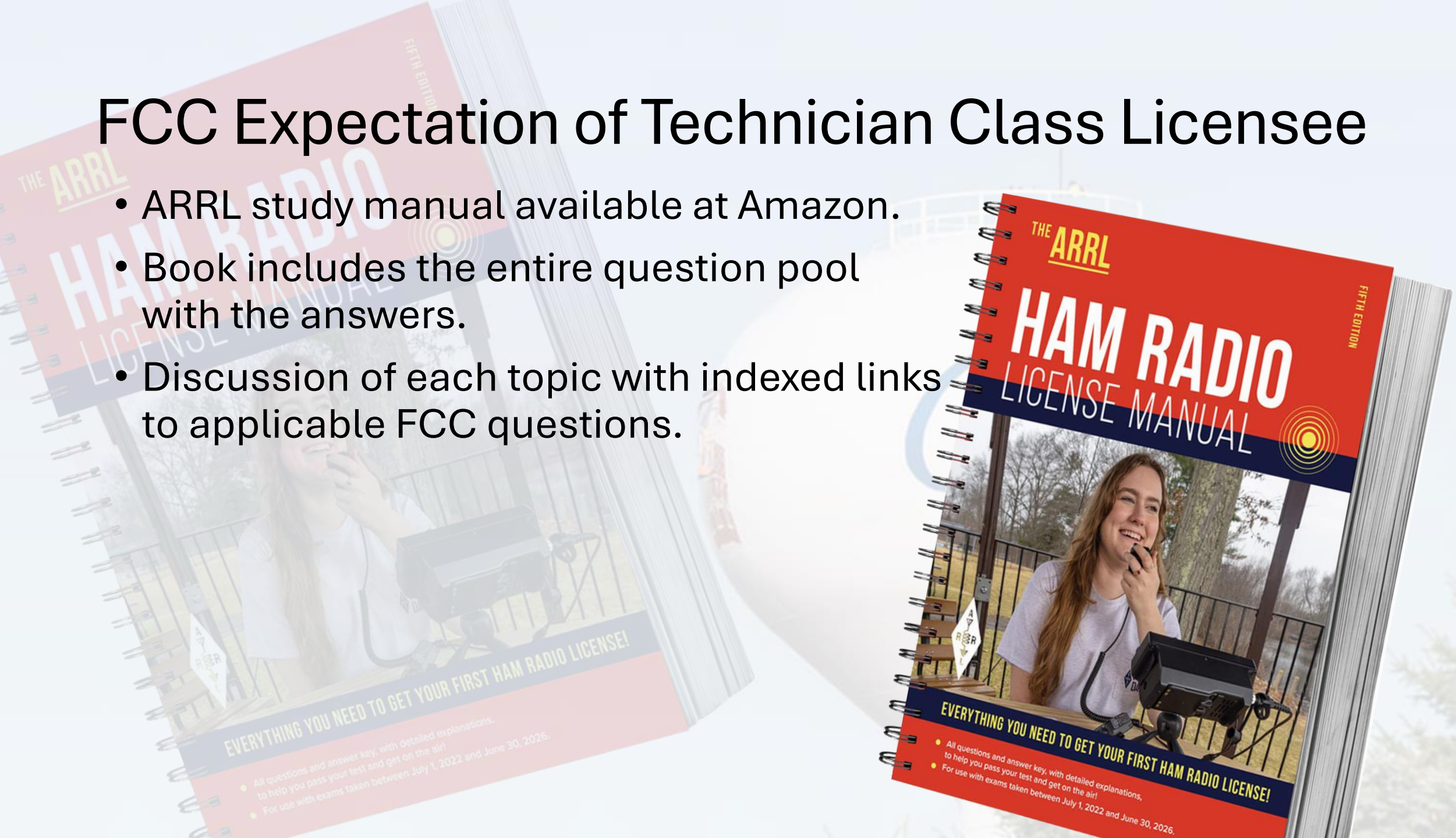
- Technician
  - Entry-level license
  - Exam is 35 questions, you must score 70% to pass.
  - Gives access to all Amateur Radio frequencies above 30 MHz.
- General
  - Adds some frequencies
  - Some rules and regulations
  - Mainly, adds questions of a technical nature
- Extra
  - Adds a bunch of questions of a technical nature.
  - Hams typically take years to reach this level.

Ham Services Available to Technician Class

- The ever-popular 2-meter services
- Types of Service
  - FM voice
  - Digital packet
  - Slow-scan television
  - Single-sideband voice
  - CW (Morse Code)
  - Others
- International contacts via satellites

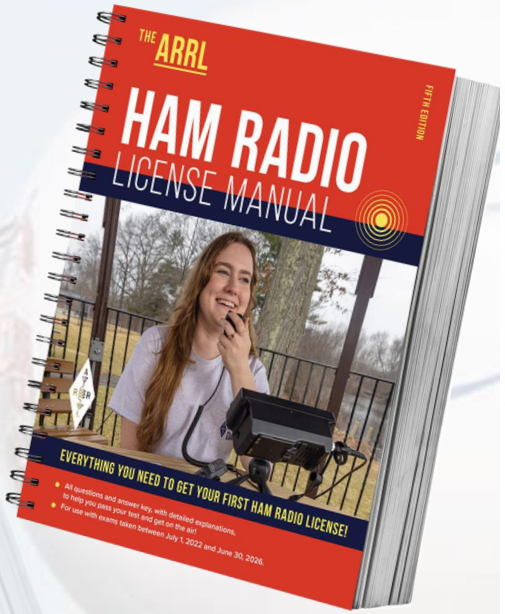
FCC Expectation of Technician Class Licensee

- ARRL study manual available at Amazon.
- Book includes the entire question pool with the answers.
- Discussion of each topic with indexed links to applicable FCC questions.



FCC Expectation of Technician Class Licensee

- Welcome
- Introduction to beginners





Chapter 1

Welcome to Amateur Radio

In this chapter, you'll learn about:

- What makes Amateur Radio unique
- Why the FCC makes the rules
- What activities you'll find in Amateur Radio
- Where you can find other hams
- The Technician license — what it is and how to get it
- Ready? Set? Go!

Welcome to the *Ham Radio License Manual*, the most popular introduction to Amateur Radio of all! In this study guide, not only will you learn enough to pass your Technician license exam, you'll also learn what ham radio is all about and how to jump right in once you're ready to get on the air.

If you want to know more about amateur or "ham" radio before you start preparing to get a license, you'll find your answers in sections beginning with "What is Amateur Radio?" If you already know about ham radio and are anxious to get started, you're in good company — there are thousands of other folks getting ready to become a ham radio operator. Jump ahead to section 1.4 — "Getting Your Ham Radio License" and get started!

1.1 What is Amateur Radio?

Amateur Radio will surprise you with all its different activities. If you've encountered Amateur Radio in a public service role or if someone you know has a ham radio in their home or car, then you already have some ideas. Maybe you have seen ham radio in a movie or read about it in a book. Are you a part of a maker community? If so, you'll really enjoy getting involved with one of the most "hands-on" hobbies of all. Amateur Radio is the most powerful communications

Jerry Clement, VE6AB, demonstrates that you don't need much equipment to make contacts through a ham radio satellite.

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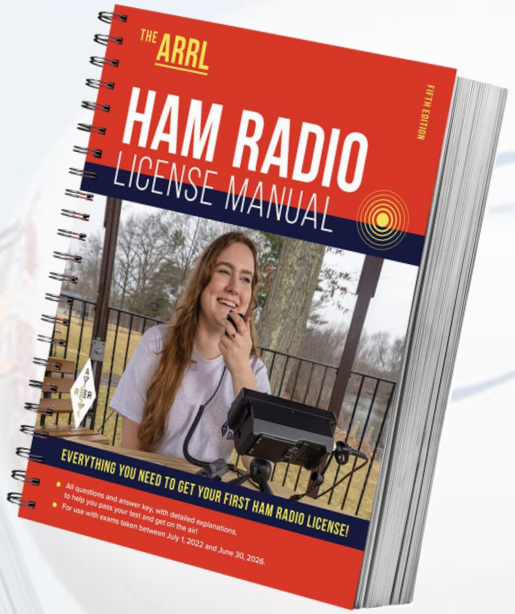
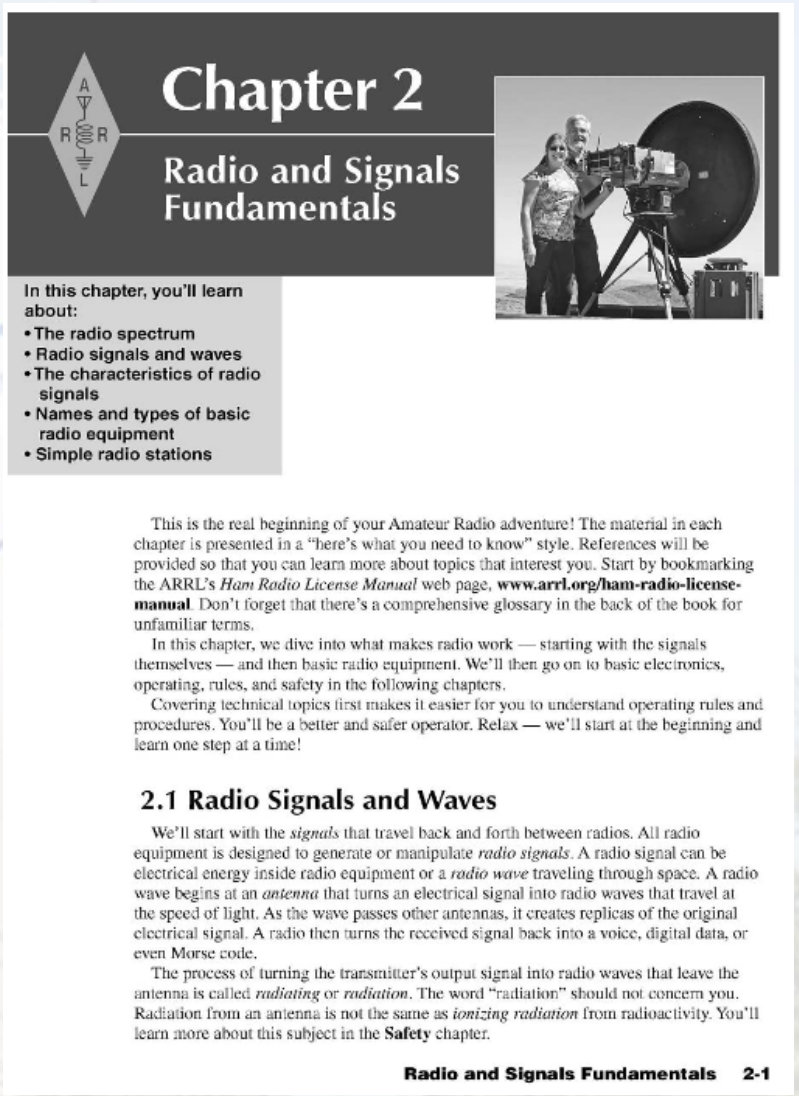
- Radio Fundamentals





Chapter 2

Radio and Signals Fundamentals

In this chapter, you'll learn about:

- The radio spectrum
- Radio signals and waves
- The characteristics of radio signals
- Names and types of basic radio equipment
- Simple radio stations

This is the real beginning of your Amateur Radio adventure! The material in each chapter is presented in a "here's what you need to know" style. References will be provided so that you can learn more about topics that interest you. Start by bookmarking the ARRL's *Ham Radio License Manual* web page, **www.arrl.org/ham-radio-license-manual**. Don't forget that there's a comprehensive glossary in the back of the book for unfamiliar terms.

In this chapter, we dive into what makes radio work — starting with the signals themselves — and then basic radio equipment. We'll then go on to basic electronics, operating, rules, and safety in the following chapters.

Covering technical topics first makes it easier for you to understand operating rules and procedures. You'll be a better and safer operator. Relax — we'll start at the beginning and learn one step at a time!

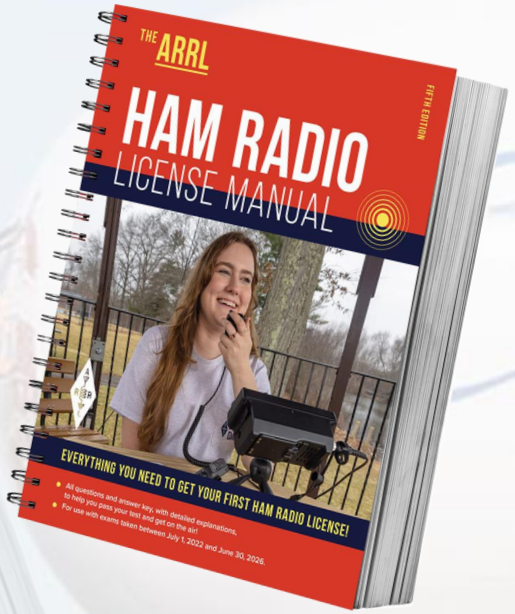
2.1 Radio Signals and Waves

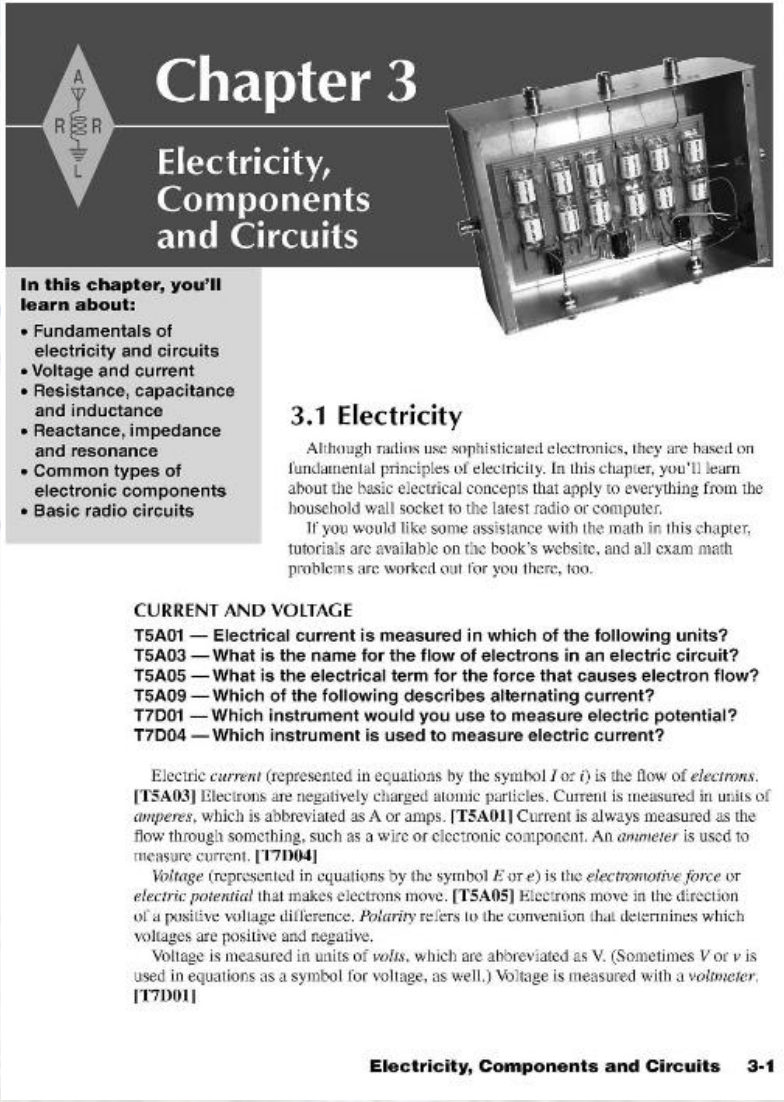
We'll start with the *signals* that travel back and forth between radios. All radio equipment is designed to generate or manipulate *radio signals*. A radio signal can be electrical energy inside radio equipment or a *radio wave* traveling through space. A radio wave begins at an *antenna* that turns an electrical signal into radio waves that travel at the speed of light. As the wave passes other antennas, it creates replicas of the original electrical signal. A radio then turns the received signal back into a voice, digital data, or even Morse code.

The process of turning the transmitter's output signal into radio waves that leave the antenna is called *radiating* or *radiation*. The word "radiation" should not concern you. Radiation from an antenna is not the same as *ionizing radiation* from radioactivity. You'll learn more about this subject in the **Safety** chapter.

FCC Expectation of Technician Class Licensee

- Electricity
- Components
- Circuits





Chapter 3

Electricity, Components and Circuits

In this chapter, you'll learn about:

- Fundamentals of electricity and circuits
- Voltage and current
- Resistance, capacitance and inductance
- Reactance, impedance and resonance
- Common types of electronic components
- Basic radio circuits

3.1 Electricity

Although radios use sophisticated electronics, they are based on fundamental principles of electricity. In this chapter, you'll learn about the basic electrical concepts that apply to everything from the household wall socket to the latest radio or computer.

If you would like some assistance with the math in this chapter, tutorials are available on the book's website, and all exam math problems are worked out for you there, too.

CURRENT AND VOLTAGE

T5A01 — Electrical current is measured in which of the following units?
T5A03 — What is the name for the flow of electrons in an electric circuit?
T5A05 — What is the electrical term for the force that causes electron flow?
T5A09 — Which of the following describes alternating current?
T7D01 — Which instrument would you use to measure electric potential?
T7D04 — Which instrument is used to measure electric current?

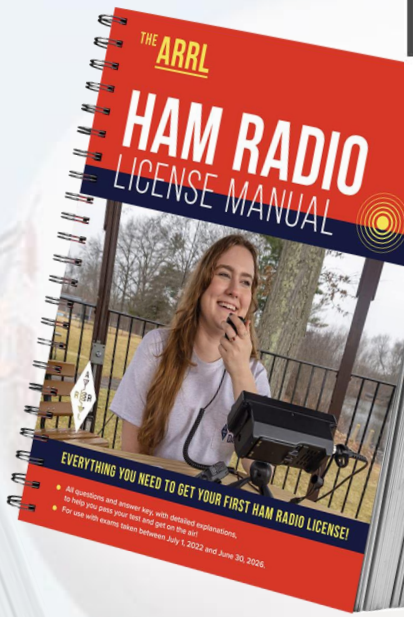
Electric *current* (represented in equations by the symbol *I* or *i*) is the flow of *electrons*. **[T5A03]** Electrons are negatively charged atomic particles. Current is measured in units of *amperes*, which is abbreviated as A or amps. **[T5A01]** Current is always measured as the flow through something, such as a wire or electronic component. An *ammeter* is used to measure current. **[T7D04]**

Voltage (represented in equations by the symbol *E* or *e*) is the *electromotive force* or *electric potential* that makes electrons move. **[T5A05]** Electrons move in the direction of a positive voltage difference. *Polarity* refers to the convention that determines which voltages are positive and negative.

Voltage is measured in units of *volts*, which are abbreviated as V. (Sometimes *V* or *v* is used in equations as a symbol for voltage, as well.) Voltage is measured with a *voltmeter*. **[T7D01]**

FCC Expectation of Technician Class Licensee

- Question Pool
- 500 questions and answers
- 35 questions selected at random for any one exam.





Chapter 10

Question Pool

Technician Class Syllabus
Effective July 1, 2022 to June 30, 2026

SUBELEMENT T1 — COMMISSION'S RULES
[6 Exam Questions — 6 Groups]

T1A Purpose and permissible use of the Amateur Radio Service; Operator/primary station license grant; Meanings of basic terms used in FCC rules; Interference; RACES rules; Phonetics; Frequency Coordinator
T1B Frequency allocations; Emission modes; Spectrum sharing; Transmissions near band edges; Contacting the International Space Station; Power output
T1C Licensing: classes, sequential and vanity call sign systems, places where the Amateur Radio Service is regulated by the FCC, name and address on FCC license database, term, renewal, grace period, maintaining mailing address; International communications
T1D Authorized and prohibited transmissions: communications with other countries, music, exchange of information with other services, indecent language, compensation for operating, retransmission of other amateur signals, encryption, sale of equipment, unidentified transmissions, one-way transmission
T1E Control operator: eligibility, designating, privileges, duties, location, required; Control point; Control types: automatic, remote
T1F Station identification; Repeaters; Third party communications; Club stations; FCC inspection

SUBELEMENT T2 — OPERATING PROCEDURES
[3 Exam Questions — 3 Groups]

T2A Station operation: choosing an operating frequency, calling another station, test transmissions; Band plans: calling frequencies, repeater offsets
T2B VHF/UHF operating practices: FM repeater, simplex, reverse splits; Access tones: CTCSS, DTMF; DMR operation; Resolving operational problems; Q signals
T2C Public service: emergency operations, applicability of FCC rules, RACES and ARES, net and traffic procedures, operating restrictions during emergencies, use of phonetics in message handling

SUBELEMENT T3 — RADIO WAVE PROPAGATION
[3 Exam Questions — 3 Groups]

T3A Radio wave characteristics: how a radio signal travels, fading, multipath, polarization, wavelength vs absorption; Antenna orientation
T3B Electromagnetic wave properties: wavelength vs frequency, nature and velocity of electromagnetic waves, relationship of wavelength and frequency; Electromagnetic spectrum definitions: UHF, VHF, HF
T3C Propagation modes: sporadic E, meteor scatter, auroral propagation, tropospheric ducting; F region skip; Line of sight and radio horizon

SUBELEMENT T4 — AMATEUR RADIO PRACTICES
[2 Exam Questions — 2 Groups]

T4A Station setup: connecting a microphone, a power source, a computer, digital equipment, an SWR meter; bonding; Mobile radio installation
T4B Operating controls: frequency tuning, use of filters, squelch function, AGC, memory channels, noise blanker, microphone gain, receiver incremental tuning (RIT), bandwidth selection, digital transceiver configuration

Study Time to Prepare…

- Given 1 hour per day of study
- 5 days per week
- Plan on 3 weeks of study time required.



Amateur Radio Clubs Common

- Virtually all regions within the United States have local clubs.
- Most clubs are affiliated with the American Radio Relay League (ARRL).

