

**The ARRL
Instructor's Manual
For Technician License Courses
Sixth Edition**

**For use with
The ARRL Ham Radio License Manual
Third Edition**

Updated by Ward Silver, NØAX

**Including *Teacher's Guide to Amateur Radio Instruction*
By Pete Kemp, KZ1Z**



Published by: _____
ARRL *The national association for*
AMATEUR RADIO
225 Main Street
Newington, CT 06111-1494 • www.arrl.org

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Printed in the USA

ISBN: 978-1-62595-018-S

Sixth Edition

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Module 1: Welcome to Amateur Radio

Module 2: Radio Waves and Signals

Module 3: Modulation & Bandwidth

Module 4: Electricity

Module 5: Ohm's Law, Power and the Metric System

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Module 6: Electronic Components

Module 7: Types of Radio Circuits

Module 8: Propagation

Module 9: Antennas and Feed Lines

Module 10: Practical Antenna Systems

Module 11: Basic Amateur Radio Station Equipment

Module 12: Power Sources and Interference

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Module 16: Call Signs and Operating Regulations, Part 1

Module 17: Call Signs and Operating Regulations, Part 2

Module 18: Safety and Amateur Radio

The Teacher's Guide to Amateur Radio Instruction, by Pete Kemp, KZ1Z

(download at www.arrl.org/arrl-technician-instructor-manual)

Introduction

Mentoring, or as we say in the hobby, “Elmering,” other new hams has from the very beginning of ham radio been a very important part of the hobby. It is the way we keep the hobby alive and help newcomers achieve success. We thank you for taking the time to teach a licensing course and for following the guidance that the ARRL is providing you through The ARRL Instructor's Manual. Instructing properly takes preparation and work. In the long run that preparation and work pays off in your students' success at passing the test and joining the ranks of Amateur Radio enthusiasts.

About the Author

A Contributing Editor to the ARRL on a number of projects, Ward Silver, NØAX, is the author of all three ARRL License Manuals and the Q&A Study Guides along with the monthly *QST* column “Hands-On Radio.” He is also the Lead Editor of the *ARRL Handbook* and the *ARRL Antenna Book*. You will find his byline in the popular Wiley Publishing's “For Dummies” series books, *Ham Radio* (now in its 2nd edition), *Two-Way Radios & Scanners*, and *Circuitbuilding Do-It-Yourself*. First licensed in 1972 and trained as an electrical engineer, he designed microprocessor-based products and medical devices for 20 years before beginning a second career as a teacher and writer.

How to Use This Resource

Are You Ready to Instruct?

As in the earlier editions, we have made certain assumptions about you as the instructor. The first assumption is that you know the hobby sufficiently to teach it. This book will not provide you with enough information to make you a content expert. Secondly, we assume that you have the skills and knowledge to instruct — or at a minimum are willing to learn those skills. We are not asking that you be a professional teacher. However, you will need to know how to take the content that you are going to teach and prepare it into lessons. Then you will need to present those lessons in an understandable and enjoyable way so that your students come away with the necessary information.

Teaching requires preparation. An old rule of thumb is that it takes two hours of prep time for every one hour of actual teaching. This is probably a good estimation. Certainly it is for teaching lessons for the first time.

An experienced teaching professional and license instructor, Peter Kemp, KZ1Z, has written *The Teacher's Guide to Amateur Radio Instruction* to offer advice from his experience as a teacher of ham radio. Targeted to the particular needs and challenges of teaching Amateur Radio license preparation classes, Pete's guide provides tips and insights into teaching and learning that are useful for beginner and experienced teachers alike. We offer it as a supplement to this manual, hoping you'll take the time to read it as preparation for organizing and leading your course.

Scope and Sequence

The ARRL Instructor's Manual offers a course syllabus that addresses all of the topics covered by the FCC question pool effective July 1, 2014, for the Technician license exam. This syllabus follows the sequence of presentation of topics in the ARRL student study guide, *The ARRL Ham Radio License Manual (HRLM)*, Third Edition, which we have developed to prepare new students of Amateur Radio for the entry level Technician exam.

The ARRL Ham Radio License Manual is organized to explain some basic concepts of radio science and electronics at an introductory level, providing sufficient background for students to gain some fundamental understanding of radio technology. Its sequence is designed to move from foundational concepts to specific details that rely on an understanding of the foundational principles.

For example, in order to understand a band chart and the concept of operating privileges, students need to understand the principle of frequency and wavelength. To understand how radio waves propagate, it would help to understand what a radio wave is. To understand how a radio station is configured to carry signals through various station components, the student needs to understand how a radio wave is modulated to carry information.

The ARRL Ham Radio License Manual and *The ARRL Instructor's Manual* do not address topics in step with the order of exam questions as presented in the FCC Technician Question Pool. A “Study Guide,” posted on *The ARRL Ham Radio License Manual* online support page at www.arrl.org/ham-radio-license-manual provides a downloadable document that students can use to study exam questions in the sequence in which related content is addressed in our study manual. Cross-references to the related Question Pool questions are also embedded within the text of the study manual.

Suggested Course Structure

These materials are intended for an in-depth classroom experience totaling approximately 20 hours that will provide time for explanation of topics, demonstrations and interaction with students. This represents a very large time commitment for instructor and students alike, and will most likely need to be condensed and instruction time shortened to fit the needs and constraints of the local audience and setting. Topics may certainly be selected for classroom discussion and lessons abbreviated and adapted to meet time constraints.

Because student backgrounds vary so widely, the time estimates of previous editions have been replaced by the number of questions covered in the module. This will give you an idea of the scope of the module and help you plan in-class time to adapt to the needs of a particular class. The student background and makeup – youth, seniors, etc. — will likely dictate a need to vary emphasis and depth of coverage. Pete Kemp, KZ1Z, discusses the need to tailor instructional time to student audiences in his *Teacher's Guide to Amateur Radio Instruction*.

Depending on the background of the students and the time available for instruction, class time can be reduced by:

- Allocating less-difficult subjects or entire modules to self-study
- Covering topics by question review only or assigning the questions as self-study
- Eliminating topics, demonstrations and material not directly tested by questions
- Directing students to review online resources outside of class

Since we know that instructors teach in a variety of formats we have developed this course in small modules that we hope will provide scheduling flexibility. Depending on the structure of your class, your audience and the time available to complete instruction you may need to re-order the sequence of presentation of some of the topics. In addition, the modular format of the lesson material makes it easier for the instructor to rearrange the sequence of topics to suit personal preferences, material already prepared, and various student backgrounds. For example, a group of technically-trained students may find it easier to jump right in to equipment and operating topics, covering fundamental items as a review or even leaving them out entirely. It is your choice and the various files and PowerPoint slides may be rearranged as you wish. When reordering topics do keep in mind the necessary scope and sequence important for learning and understanding the topics being presented.

The Lesson Plan Modules

The lesson plan modules presented here were written as a framework and starting point for your preparation to teach. Each module is keyed to one of the nine *ARRL Ham Radio License Manual* chapters. Each module is supported by one PowerPoint presentation that contains the actual FCC test questions and answers that the lesson module is written to address. You are encouraged to use these questions to quiz your students during and at the end of that lesson in preparation for the test.

Lesson plan modules are incremental road maps to help you progress through a lesson and reach the objectives specified for the particular lesson. The format used for these lesson plan modules provides the following.

Applicable Chapter

Study & Lesson Materials

Recommended Strategy Elements

First, the applicable chapter is identified so that you know which chapter this particular lesson plan module supports.

Study and lesson materials are listed next in the lesson plan module. This list of materials is what we recommend you have on hand to prepare for and teach the lesson.

Next, a recommended strategy for the lesson is described. We suggest during the first class that you introduce yourself, your qualifications, time in the hobby and special Amateur Radio interests would be appropriate. Also introduce any co-instructors who will work with you during their first session. We recommend that you allow students to introduce themselves as well. Note any special talents or backgrounds of students that may be “tapped” as you teach the lesson.

Module Learning Objectives

The next section of the lesson plan module is the Module Learning Objectives. These statements describe what is expected of the student upon completion of the lesson. They are derived from the chapter in *The ARRL Ham Radio License Manual* that supports the instruction. Additionally, the specific FCC Technician License Pool Questions that pertain to these objectives are included by each objective statement.

Lesson Topics	
Topic	Notes

The next section is the Lesson Topics section. The specific information to be taught is included in outline fashion in the left-hand Topic column. The topics in this outline follow the material in the chapter and include references to the FCC test questions. Corresponding in the Notes column are keys to the PowerPoint slides that support the lesson material topics. Cues to demonstrations, quizzes, etc. are also included in the Notes column.

Progress Check	
Question Stem	PowerPoint Slide

The next section in the Lesson Plan Module is the Progress Check. The left-hand column has the Question Stem – the multiple-choice question that poses the question along with the FCC Question Pool Item Number. Corresponding in the right-hand column is the PowerPoint slide number for that question item. You may first show the item and pose the question to the class. The first slide for the item poses the question and the four possible answer choices. Solicit the correct response. The next slide in sequence shows that item with the correct answer highlighted in bold. Here, you may review the lesson material just presented and give students an opportunity to rehearse the actual questions they will encounter on the exam.

At points throughout the modules the instructor is prompted to do a progress check to assess student mastery of the material. To do so, use the provided Question Pool questions. You may pose these questions verbally or as a written quiz. Your students’ ability to respond correctly will cue you as to their mastery of the subject. You may have to further reinforce some material before continuing with a lesson or moving on to the next lesson module.

All of the questions in the FCC Technician Question Pool are included in the full set of Lesson Plan Modules. If the student masters all of these questions for each Lesson Plan Module, then the student will have no trouble passing the exam.

Suggested Activities & Demonstrations

This section of the Lesson Plan Module provides suggestions for demonstrations and suggested activities to augment the information provided in the lesson material.

Homework Suggestions to Reinforce Lesson Materials

Having presented the lesson, this next section of the Lesson Plan Module provides guidance for your students' outside study. Reading assignments and pages in the Ham Radio License Manual are presented for the lesson completed and next lesson in the series. Suggested readings in addition to the *HRLM* are provided as well.

Question Pool – Applicable Questions

All of the FCC Question Pool items applicable to the chapter of the *HRLM* that this Lesson Plan Module supports are listed here.

Other ARRL Resources for Study and Instruction

ARRL Technician Q & A

In addition to the *Ham Radio License Manual*, ARRL offer a new sixth edition of the *Technician Q & A*. The *Q & A* provides short answers to explain every question in the FCC Technician (Element 2) question pool. It offers students a great way to review for the exam.

Ham Radio License Manual Online Supplement

This supplement on the ARRL website at www.arrl.org/ham-radio-license-manual provides:

- A downloadable “Study Guide” with the Question Pool exam questions in order of presentation in *The ARRL Ham Radio License Manual*;

- Supplemental material to assist students in comprehension of topics discussed in the study manual, including math tutorials;
- Updates and corrections to the manual that have been discovered after publication.

ARRL Exam Review for Ham Radio

ARRL offers a new exam practice application, *ARRL Exam Review for Ham Radio*, available as an online web-based service at www.arrl.org/examreview. This is a browser-based online application for computer, tablet or other mobile device. You may find this application convenient to use in a classroom review session since it provides the ability to review exam questions in sequence with the presentation of topic discussions in *The ARRL Ham Radio License Manual*. It also provides the ability to review questions in FCC Technician question pool order. The application also includes the convenient feature of being able to print practice exams for you or your students.

Website Instructor Resource Page

This is the section of the ARRL website where you will find resources referenced in this *Instructor's Manual*: www.arrl.org/resources-for-license-instruction. This site is continuously updated as we discover more resources that might assist you in your instruction.

Instructor Registration

You can register with the ARRL at www.arrl.org/license-instructor-registration to:

- Receive access to our website to list your classes (www.arrl.org/list-a-license-class);
- Receive access to proprietary instruction materials;
- Take advantage of our Instructor Discount Program to purchase study manuals and other resources for instruction at a 25% discount (www.arrl.org/instructor-discount-program);
- Receive our e-newsletters, which will provide tips and information and stories from other instructors that you may find useful in your instruction (www.arrl.org/announcements-news-briefs-newsletters).

Graduation Kits

ARRL provides a kit of printed forms that includes a Course Completion Certificate, First Contact Award, Amateur Radio Band Chart, Worked All States map and ARRL membership application. (All these items are also available for download from our website.) If you would like to order a kit or some of these individual items for your class, please use the order form that you will find on our website's Instructor Resource page (www.arrl.org/resources-for-license-instruction). Note that there is a lead time of approximately two weeks for these materials.

ARRL Volunteer Examiner Resources

You'll find a description of Volunteer Examiner services and resources on our website at www.arrl.org/volunteer-examiners.

Promoting ARRL Membership

We hope you will encourage your students to consider supporting ARRL by becoming a member!

We have provided a PowerPoint presentation on the ARRL instructor resource page of the ARRL website at www.arrl.org/resources-for-license-instruction that you may use to discuss ARRL membership.

You will also find a description of ARRL member benefits in the front of *The ARRL Ham Radio License Manual*, along with a tear-out membership form. Or you can direct your students to the ARRL website to join at www.arrl.org/join. You may also print a copy of our membership application for your students from the link provided on that page (use the "Print Application" button).

Copyrights and Distribution

As noted at the beginning of *The ARRL Instructor's Manual*, this publication is copyrighted material. You are free to reproduce and distribute limited portions of *The ARRL Instructor's Manual* or *The ARRL Ham Radio License Manual* as needed for the purposes of instruction of your class. However, please do not scan or post copies of this material, including photos, drawings and illustrations on the Web. This would be considered an infringement of the provision of the ARRL copyright.

A Note from the ARRL Education Services Manager

Remember there is no single right way to conduct a license class. The needs of your students and their abilities, combined with your knowledge and experience, along with the constraints and opportunities of your circumstances, are all factors that will influence your instructional plan and the structure of your class. Clear definition of your objectives and adequate planning and preparation will set the stage for a successful outcome.

Leading instruction is an important undertaking, requiring a substantial commitment. We know that your personal experience with Amateur Radio generates the passion to share Amateur Radio with others, and we hope your experience as an instructor will further fuel that passion!

Please contact us in the Education Services Department if you have a request or question and to share your ideas and suggestions. You can reach us through the general mailbox at ead@arrl.org or you can contact me personally at djohnson@arrl.org.

73,

Debra Johnson, K1DMJ

ARRL Education Services Manager