

THE **ARRL**

FIFTH EDITION

HAM RADIO LICENSE MANUAL



EVERYTHING YOU NEED TO GET YOUR FIRST HAM RADIO LICENSE!

- All questions and answer key, with detailed explanations, to help you pass your test and get on the air!
- For use with exams taken between July 1, 2022 and June 30, 2026.



Amateur Radio Technician Exam Preparation Course



ARRL
The National Association for
Amateur Radio®

Amateur Radio Technician Exam Prep Course

Welcome to Amateur Radio!

- 1.1 What is Amateur Radio
- 1.2 The FCC and Licensing
- 1.3 Amateur Radio Activities
- 1.4 Getting Your Ham Radio License

Introductions

- Instructors
 - Name
 - Callsign
 - Background
- Students
 - Name
 - About yourself
 - Why are you taking this course?
 - What do you know about ham radio?

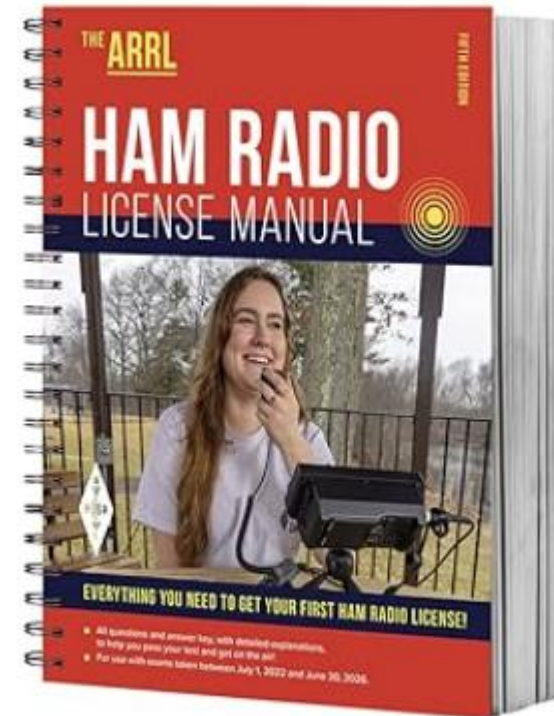
The Plan for This 6-Week Class

Our objective: prepare you to take the Technician amateur radio license exam!
The license will authorize you to operate an amateur radio transmitter

- Feb 9 Welcome to Amateur Radio!
- Feb 16 Radio Fundamentals & Electricity, Components and Circuits
- Feb 23 Licensing Regulations & Operating Regulations
- Mar 2 Ham Equipment & Communicating With Other Hams
- Mar 9 Propagation, Antennas, Feedlines & Safety
- Mar 16 Preparing for the Exam & Review

Study Aids: ARRL License Manual

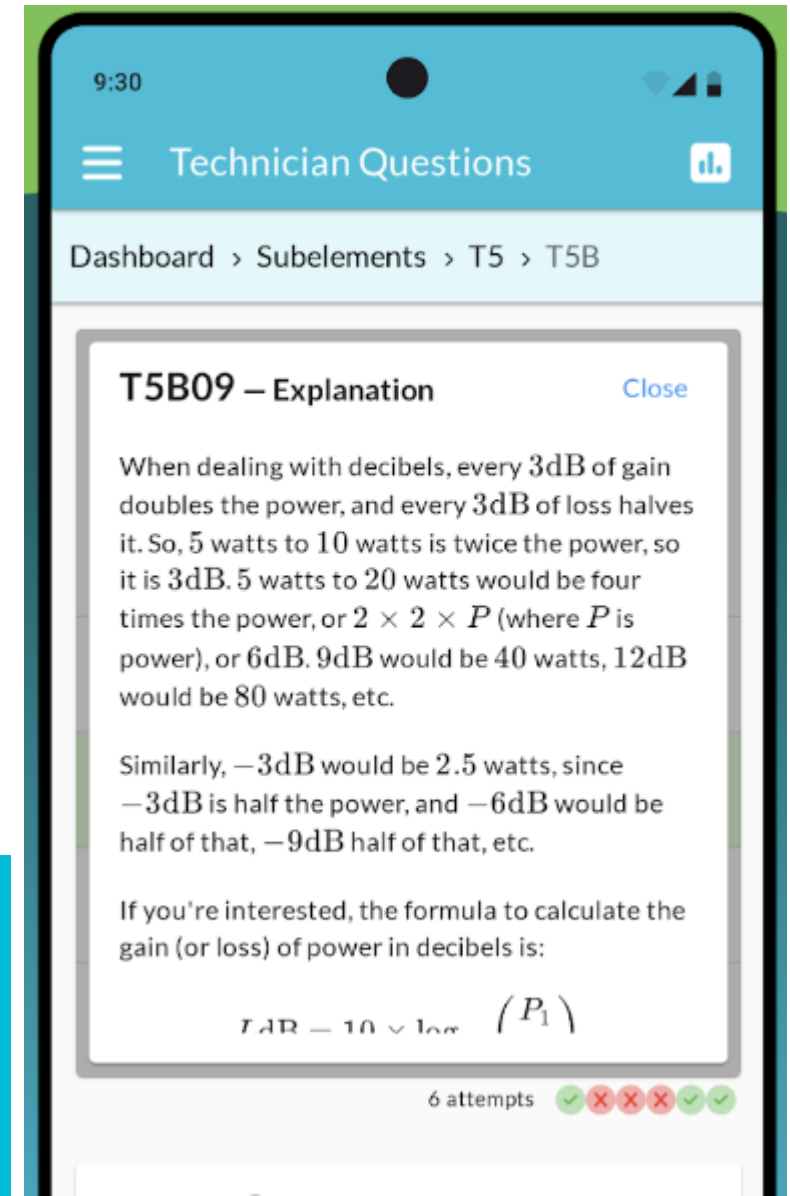
- Recommended: ARRL License Manual
 - ~\$35
 - Includes complete question pool
- New edition in 2022
 - Make sure you have the 5th edition
- Additional resources available online
 - <https://www.arrl.org/ham-radio-license-manual>



We'll be following the ARRL License manual, but other books are also great!

Study Aids: Digital Tools

- Websites with practice tests:
 - Eham.net, hamexam.org, arrl.org
- Apps
 - HamTech+ (iOS)
 - HamStudy (Android)
- Youtube
 - Ham Radio Crash Course
- Additional online resources
 - <https://hambook.org/>
 - <https://newhams.info/>



Today's Plan

- What is amateur radio?
- What can you do with amateur radio?
- Why is amateur radio useful here in the mountains?
- How does amateur radio compare with GMRS?
- Study resources & exam prep resources

What is Amateur Radio?

- **Amateur (or Ham) Radio is a personal radio service authorized by the Federal Communications Commission (FCC)**
 - To encourage the advancement of the art and science of radio
 - To promote the development of an emergency communication capability to assist communities when needed
 - To develop a pool of trained radio operators
 - To promote international goodwill by connecting private citizens in countries around the globe
- Through ham radio, you will become an ambassador for your community and your country

More About Amateur Radio ...

- The Amateur Radio Service is governed by Part 97 of the FCC Rules and Regulations *
- Anyone can be a ham radio operator, there is no age limit
- Amateur Radio operators cannot accept payment of any type for operating their radio, whether money or other goods or services **

* The exact reference is “Title 47 Code of Federal Regulations (CFR) Part 97” or **47 CFR Part 97**

** What if I want to get paid! You can ... get a **Commercial Radio Operator License** ...

<https://www.fcc.gov/commercial-radio-operator-license-program>

What Do Hams Do?

- Communicate
- Experiment
- Build
- Compete
- Serve their communities
- Engage in lifelong learning
- Talk to people (near and far)
- Build stuff (receivers, antennas, etc.)
- Emergency Communications (EmComms)
- First-person view drones, high-altitude balloons, rocket telemetry
- Bounce signals off moon, asteroids, etc.
- Digital, packet radio
- Repeaters, networks (including data!)

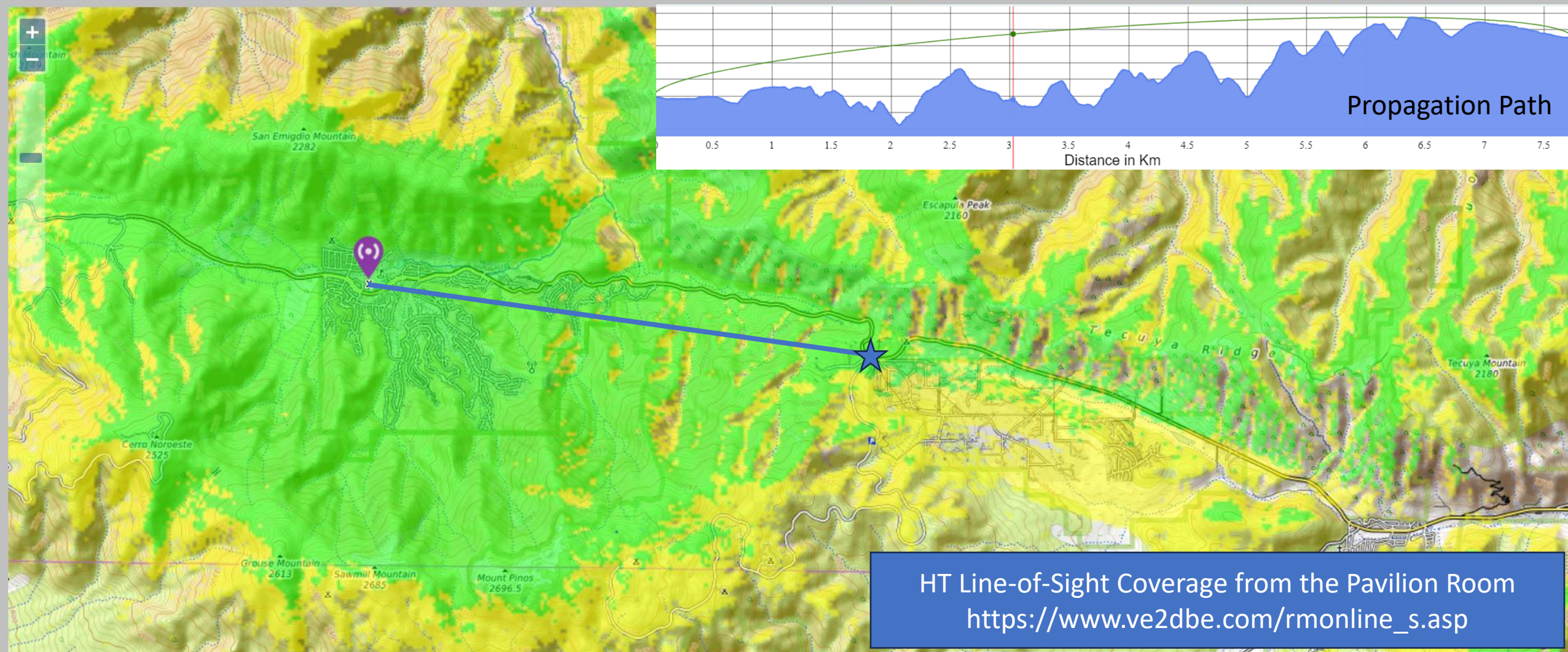
VHF/UHF: Line of Sight Radio



Radio Mobile

Par/By Roger Coudé VE2DBE

Information



HF: Long-Distance Radio

On , show using over the last [Display options](#) [Permalink](#)

Monitoring KB6C (last report 2 mins ago). Automatic refresh in 4 minutes. Small markers are the 1559 transmitters ([show logbook](#)) heard ([distance chart](#)) at KB6C (11678 reports, 96 countries last 24 hours; 82375 reports, [114 countries](#) last week).

There are [6587 active monitors](#): [1639 on 20m](#), [1499 on 40m](#), [1420 on 10m](#), [797 on 15m](#), [702 on 80m](#), [695 on 30m](#), [661 on 12m](#), [533 on 17m](#), [289 on 60m](#), [258 on 160m](#), [221 on 6m](#), [140 on 2m](#), 35 on unknown, [28 on 600m](#), [20 on 70cm](#), [20 on 11m](#), [15 on 2.4Ghz](#), [13 on 2200m](#), 8 on 10Ghz, 7 on invalid, [5 on 23cm](#), [2 on 4m](#), [1 on 8m](#), [1 on 1.25m](#). [Legend](#)

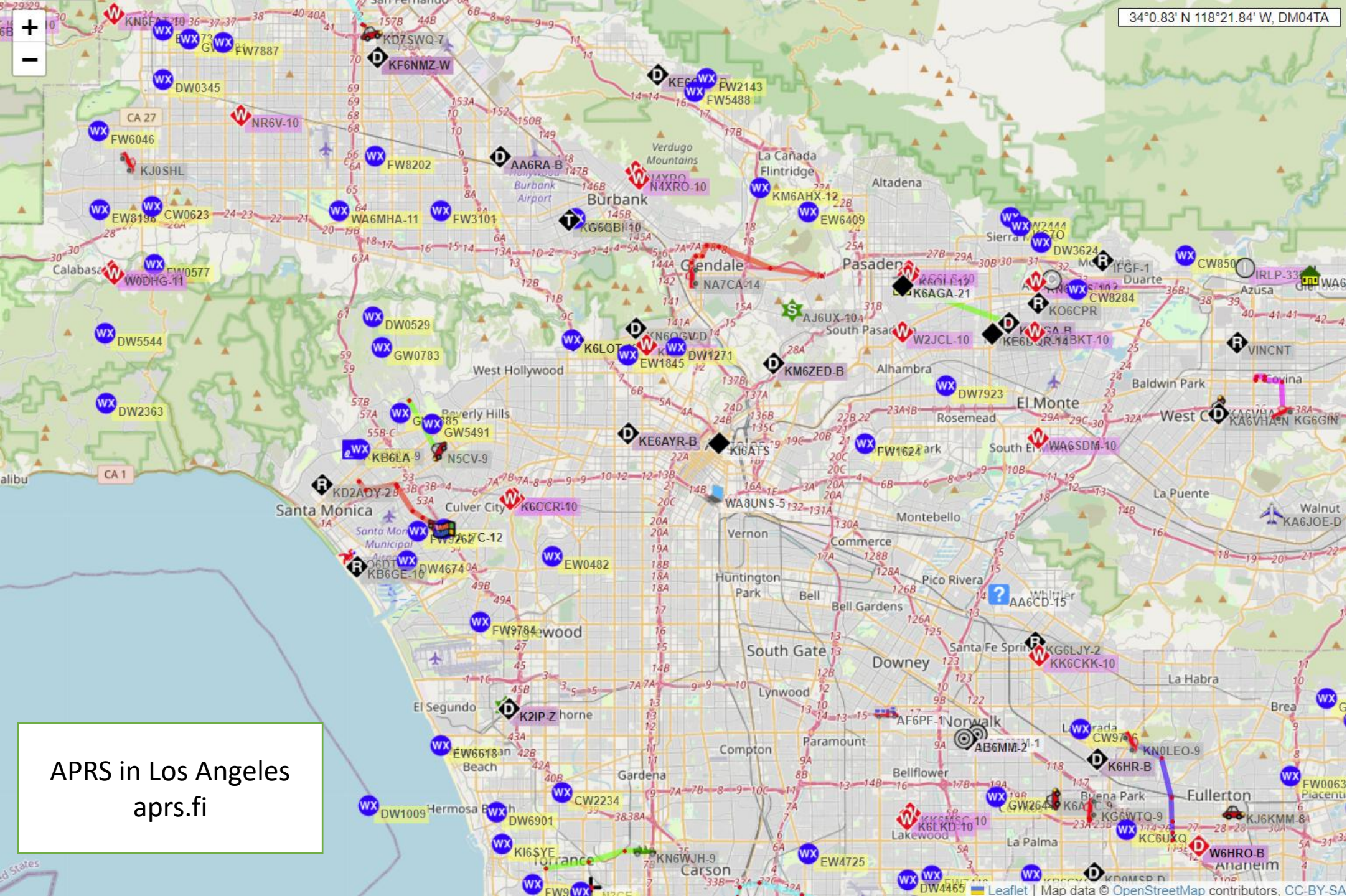


Rx at Sat, 08 Feb 2025 21:36:15 GMT

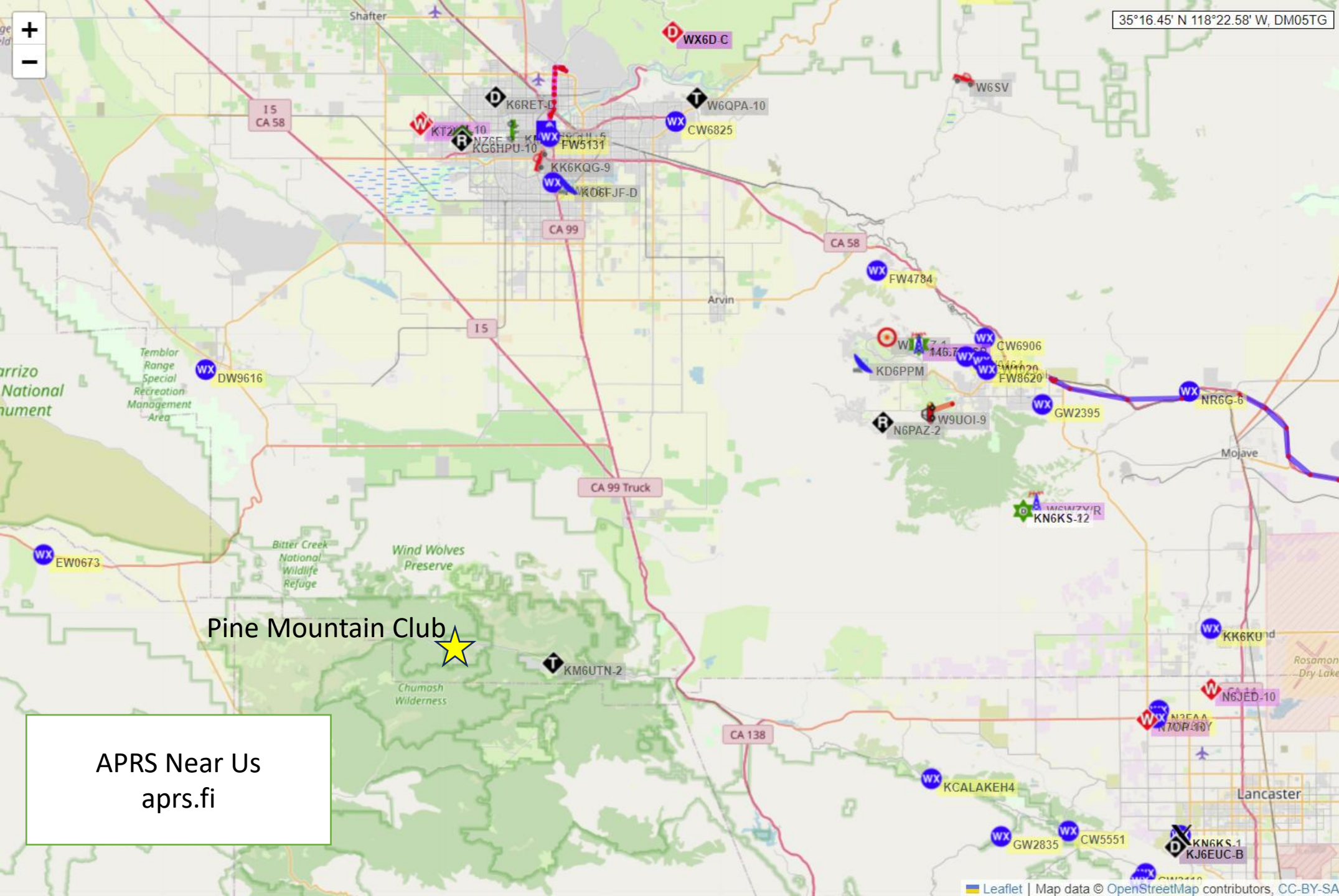
From [JF3VAX](#) in Ōsaka, Japan

Log RM744 by KB6C

<https://pskreporter.info>



APRS in Los Angeles
aprs.fi



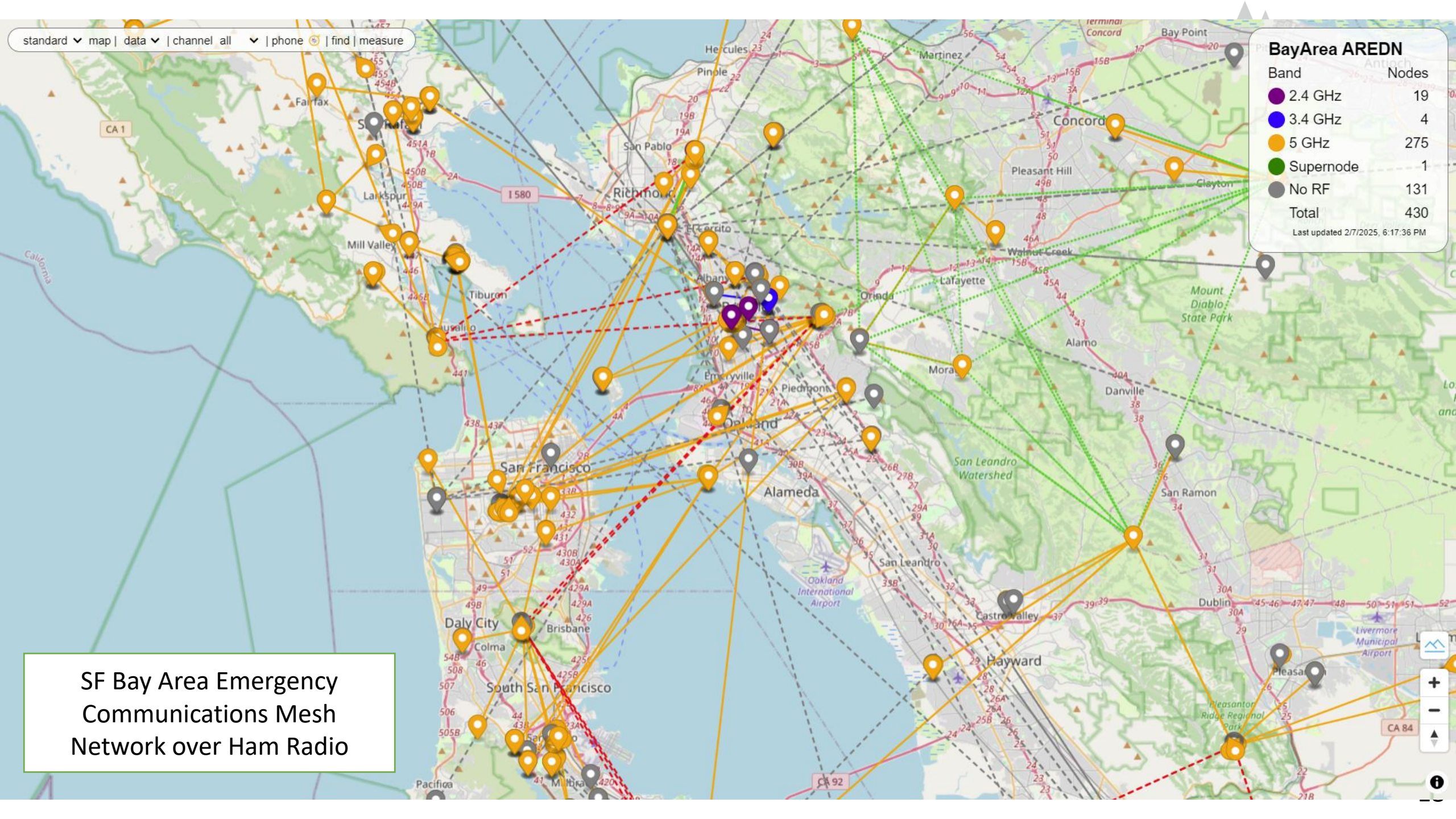
standard ▾ map | data ▾ | channel all ▾ | phone ☎ | find | measure

BayArea AREDN

Band	Nodes
2.4 GHz	19
3.4 GHz	4
5 GHz	275
Supernode	1
No RF	131
Total	430

Last updated 2/7/2025, 6:17:36 PM

SF Bay Area Emergency Communications Mesh Network over Ham Radio



Frequencies

- Licenses give you access to different frequency “bands”
- HF “High Frequency”
 - Long distance contacts, big amps, big antennas, (generally) expensive radios
- VHF, UHF (“Very/Ultra High Frequency”)
 - Handheld or car-mounted radios, repeaters, packet radio, digital radio
- Above UHF
 - Experimental, remote control (first-person view), mesh nets, packet radio
- The FCC manages licenses for exclusive access to many frequencies
 - Examples: TV, FM radio, Cell services, Public Safety Departments, etc.

UNITED STATES FREQUENCY ALLOCATIONS

THE RADIO SPECTRUM

RADIO SERVICES COLOR LEGEND



ACTIVITY CODE

 NON-FEDERAL EXCLUSIVE

ALLOCATION USAGE DESIGNATION

SERVICE	EXAMPLE	DESCRIPTION
Primary	FIXED	Capital Letters
Secondary	Mobile	1st Capital with lower case letters

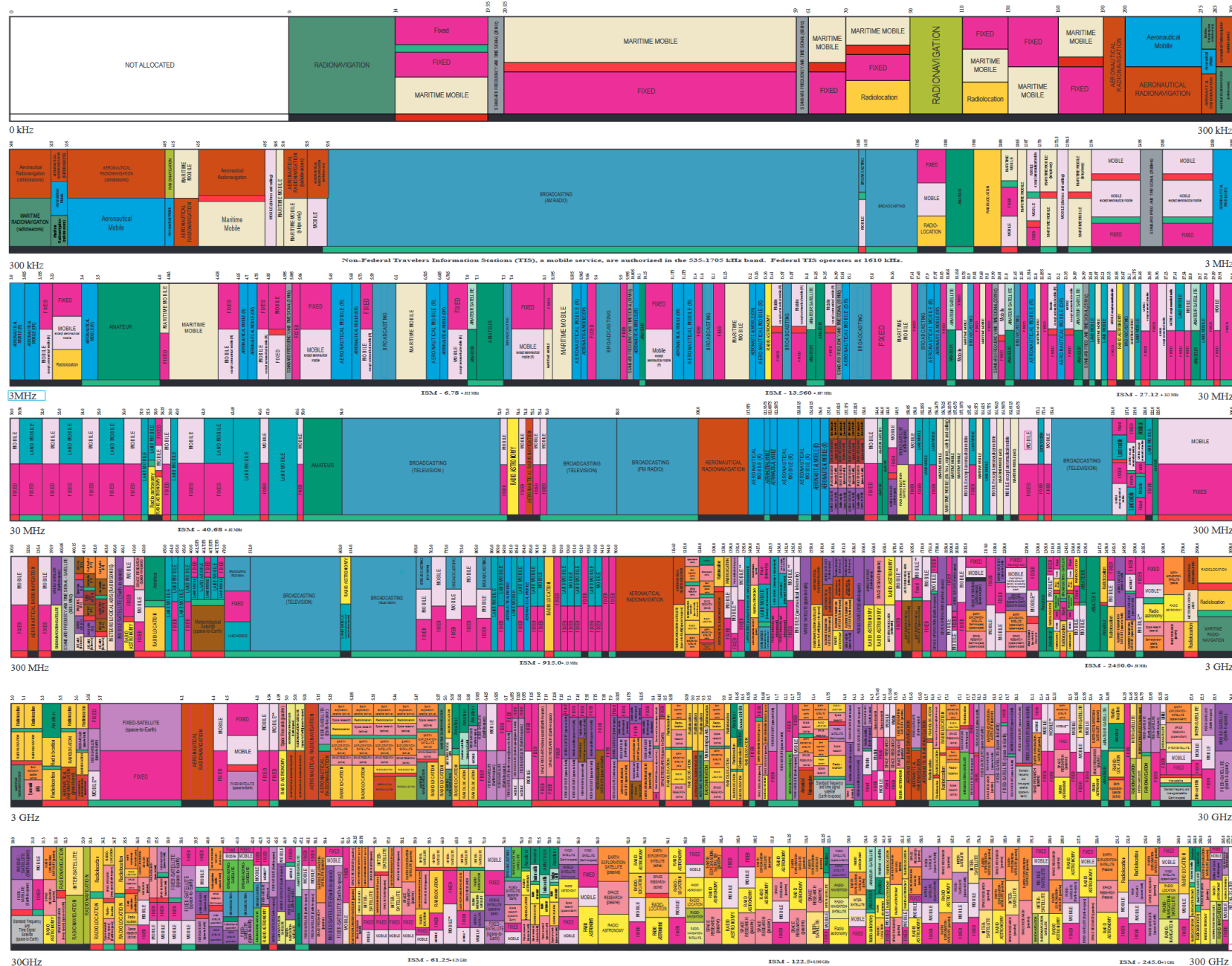
This chart is a graphic single-point-in-time portrayal of the Table of Frequency Allocations used by the FCC and NTIA. As such, it does not completely reflect all events, i.e., footnotes and recent changes made to the Table.

 **U.S. DEPARTMENT OF COMMERCE**
National Telecommunications and Information Administration
Office of Spectrum Management

JANUARY 2016

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For more information, call 800-451-4243 or visit www.fda.gov/oc/foia.
 Faxmail: (301) 713-3150 Mail Stop 8808, Washington, DC 20403-0881



<https://www.ntia.gov/page/united-states-frequency-allocation-chart>

PLEASE NOTE: THE SPACING ALLOTTED THE SERVICES IN THE SPECTRUM SEGMENTS SHOWN IS NOT PROPORTIONAL TO THE ACTUAL AMOUNT OF

SPACES OCCUPIED:

Amateur Radio “Bands”

STATES FREQUENCY ALLOCATIONS

THE RADIO SPECTRUM



ACTIVITY CODE

FEDERAL EXCLUSIVE FEDERAL/NON-FEDERAL SHARED

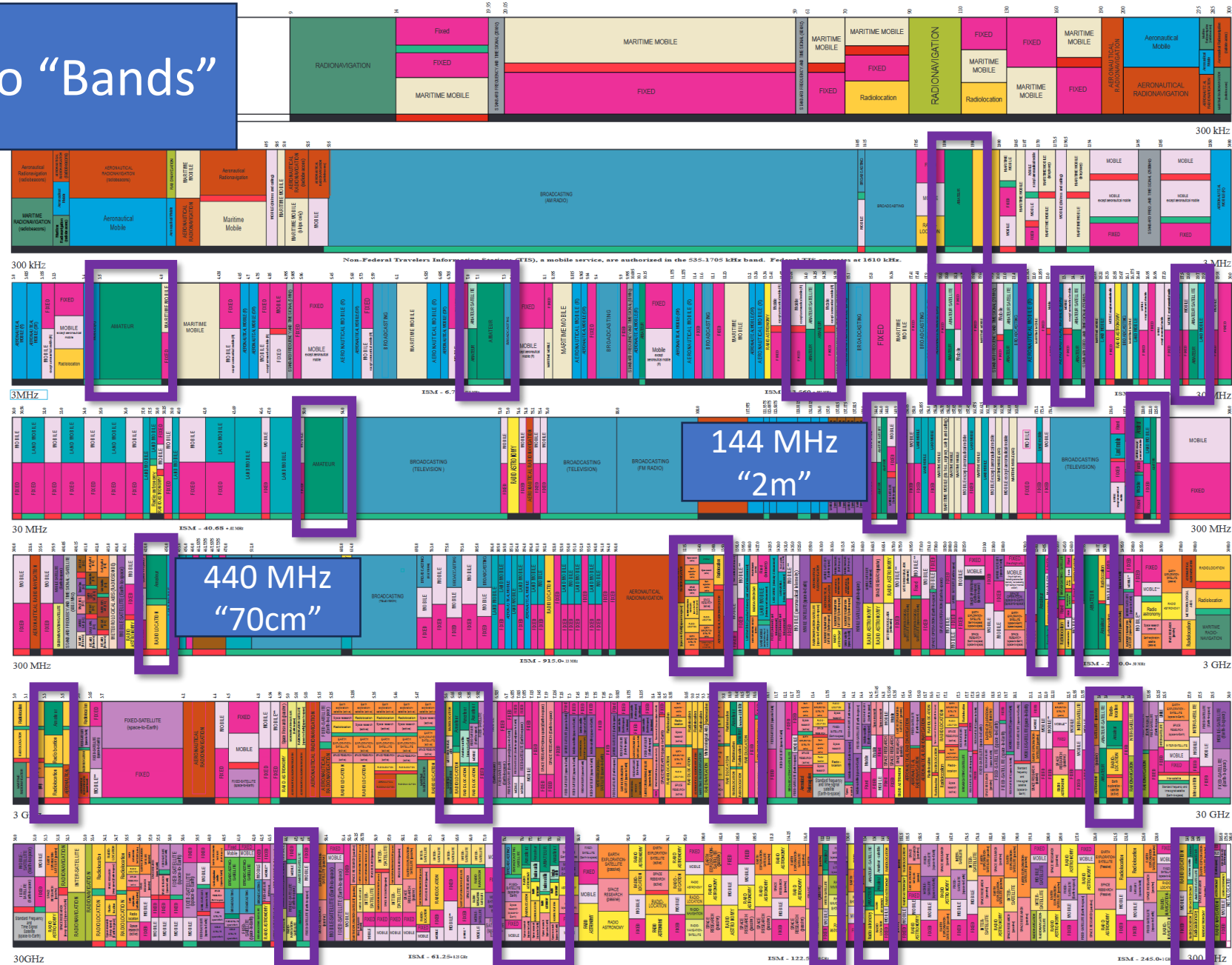
NON-FEDERAL EXCLUSIVE

ALLOCATION USAGE DESIGNATION

SERVICE	EXAMPLE	DESCRIPTION
Primary	FIXED	Capital Letters
Secondary	MOBILE	1st Capital with lower case letters

This chart is a graphic single-point-in-time portrayal of the Table of Frequency Allocations and is the FCC and NTIA. It is not a complete listing of all frequencies, but it is a summary of the current status of U.S. allocations.

U.S. DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Office of Spectrum Management
JANUARY 2016



ARRL
The National Association for
Amateur Radio®

HF

VHF

UHF

<https://www.ntia.gov/page/united-states-frequency-allocation-chart>

PLEASE NOTE: THE CHART ALLOTTED THE SERVICES IN THE SPECTRUM
REQUIREMENTS ARE NOT PROPRIETARY TO THE ACTUAL ALLOCATION
SPECTRUM OCCUPY.

Levels of Amateur Licenses

1. Technician *(this class)*

- All bands from 50 MHz and up
- CW (morse code) in HF bands
- Single Sideband on 28 MHz band

2. General

- Voice and data in most of the HF bands

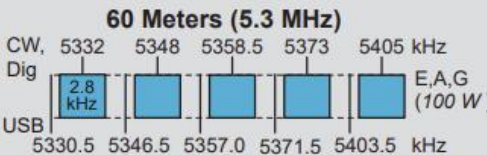
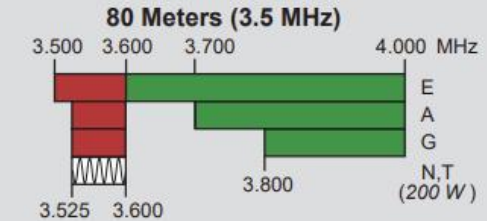
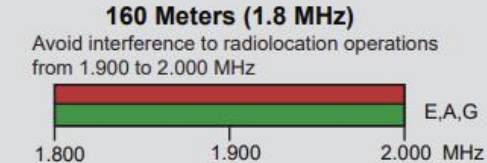
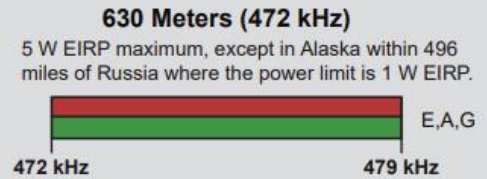
3. Amateur Extra

- A little more spectrum in HF

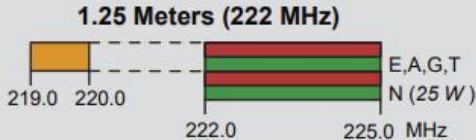
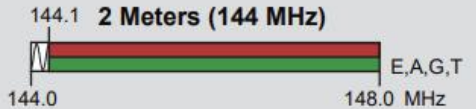
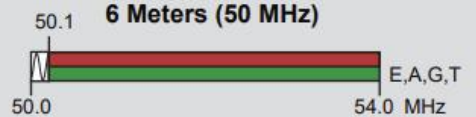
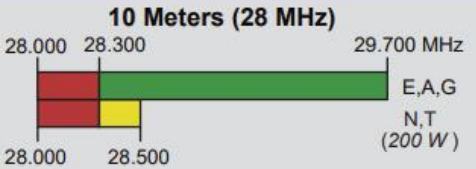
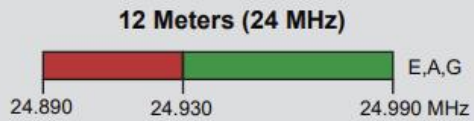
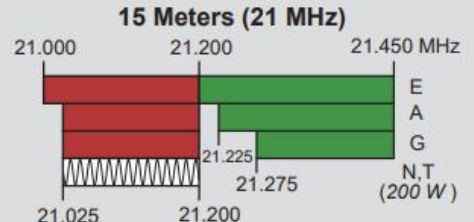
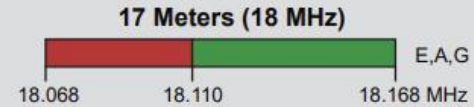
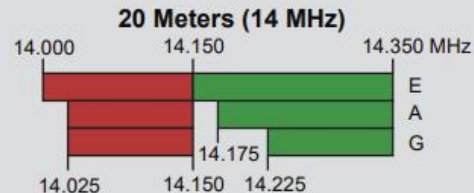
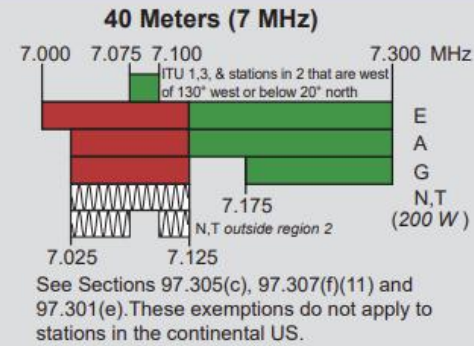
US Amateur Radio Bands

US AMATEUR POWER LIMITS — FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

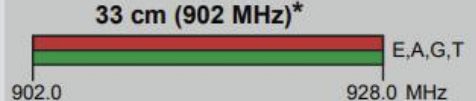
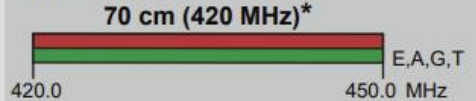
Amateurs wishing to operate on either 2,200 or 630 meters must first register with the Utilities Technology Council online at <https://utc.org/plc-database-amateur-notification-process/>. You need only register once for each band.



General, Advanced, and Extra licensees may operate on a secondary basis with a maximum ERP of 100 W (relative to a half-wave dipole antenna).



*Geographical and power restrictions may apply to all bands above 420 MHz. See FCC Part 97.303 for information about your area.



All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz	10.0-10.5 GHz ‡	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3400-3450 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	76.0-81.0 GHz	All above 275 GHz

‡ No pulse emissions



KEY

Note:
CW operation is permitted throughout all amateur bands.
MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.
Test transmissions are authorized above 51 MHz, except for 219-220 MHz

- RTTY and data
- phone and image
- CW only
- SSB phone
- USB phone, CW, RTTY, and data
- Fixed digital message forwarding systems only

E = Amateur Extra
A = Advanced
G = General
T = Technician
N = Novice

See www.arrl.org/band-plan for detailed band plans.

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email: newham@arrl.org

Exams: 860-594-0300 email: vec@arrl.org



Bands Allowed with a Technician License



KEY

Note:

CW operation is permitted throughout all amateur bands.

MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.

Test transmissions are authorized above 51 MHz, except for 219-220 MHz

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone, CW, RTTY, and data
- = Fixed digital message forwarding systems only

E = Amateur Extra
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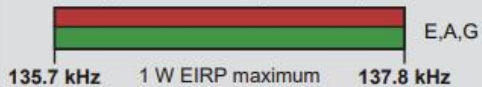
Colors denotes mode

- Red = Data
- Green = voice/image
- Squiggles = Morse Code
- Yellow = Single Sideband

Also note extra bands above 2.3 GHz!

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2,200 Meters (135 kHz)



630 Meters (472 kHz)

5 W EIRP maximum, except in Alaska within 496 miles of Russia where the power limit is 1 W EIRP.

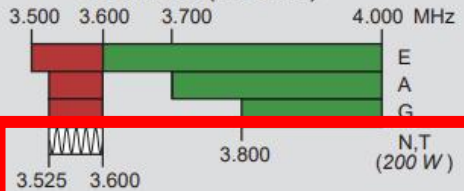


160 Meters (1.8 MHz)

Avoid interference to radiolocation operations from 1.900 to 2.000 MHz



80 Meters (3.5 MHz)

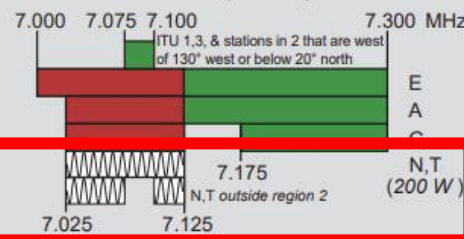


60 Meters (5.3 MHz)



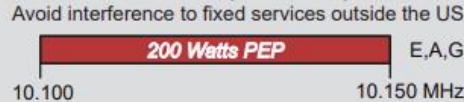
General, Advanced, and Extra licensees may operate on a secondary basis with a maximum ERP of 100 W (relative to a half-wave dipole antenna).

40 Meters (7 MHz)

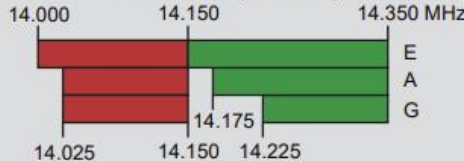


See Sections 97.305(c), 97.307(f)(11) and 97.301(e). These exemptions do not apply to stations in the continental US.

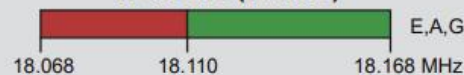
30 Meters (10.1 MHz)



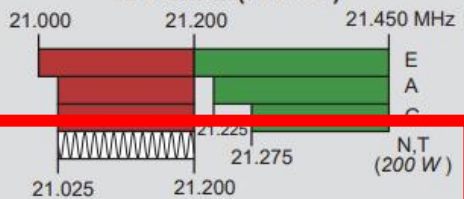
20 Meters (14 MHz)



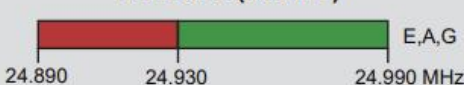
17 Meters (18 MHz)



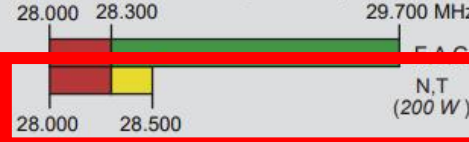
15 Meters (21 MHz)



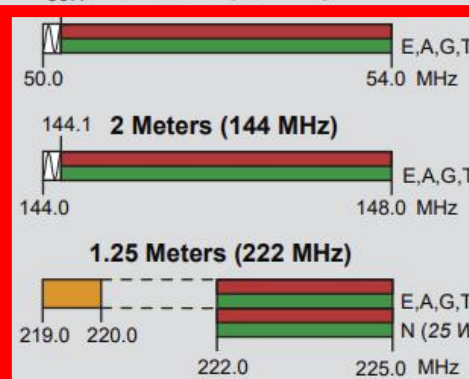
12 Meters (24 MHz)



10 Meters (28 MHz)

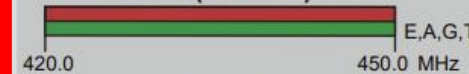


6 Meters (50 MHz)

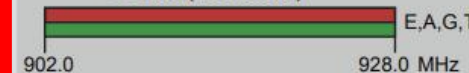


*Geographical and power restrictions may apply to all bands above 420 MHz. See FCC Part 97.303 for information about your area.

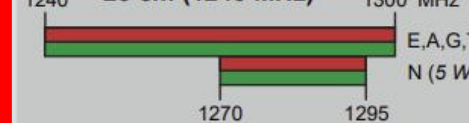
70 cm (420 MHz)*



33 cm (902 MHz)*



23 cm (1240 MHz)*



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‡ No pulse emissions

Most VHF/UHF Handheld Radios



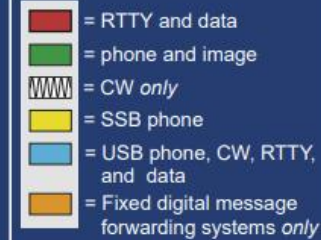
KEY

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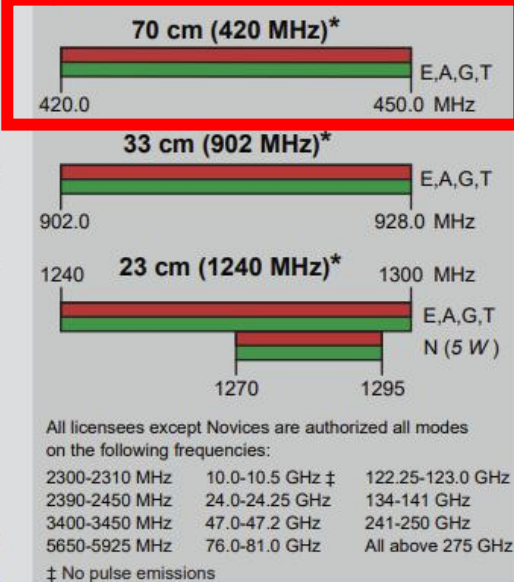
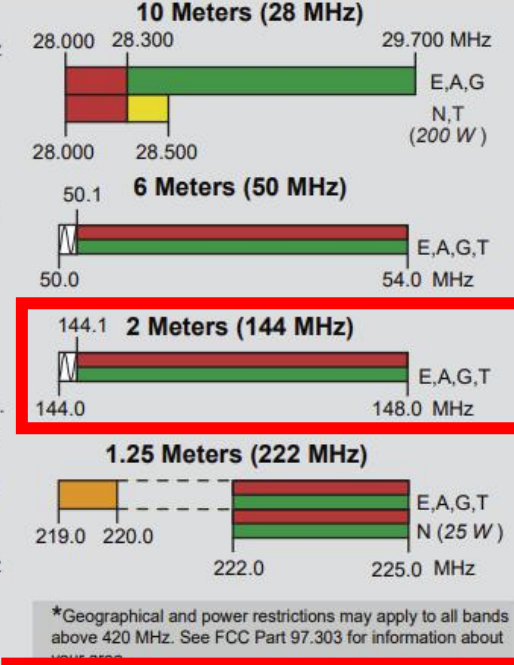
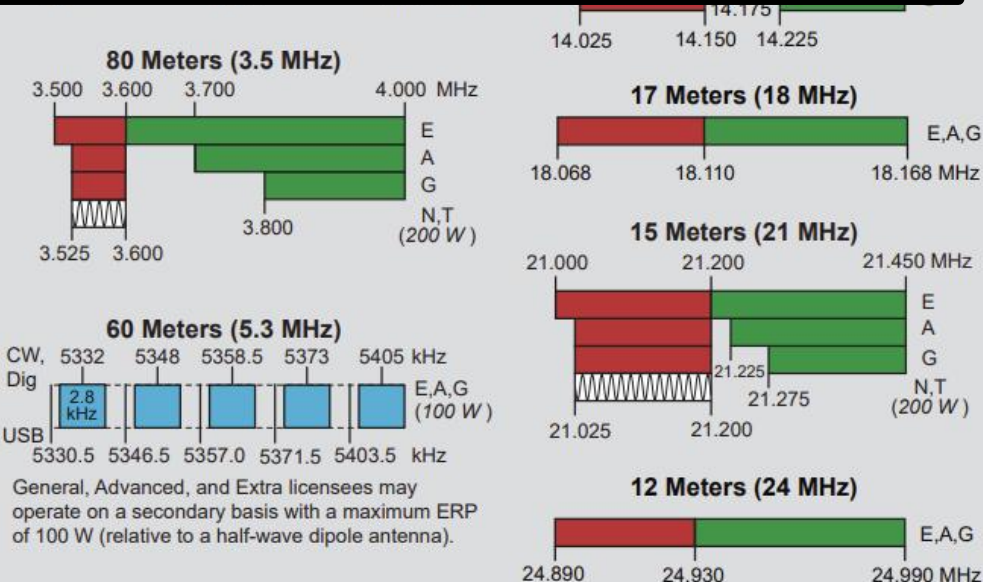
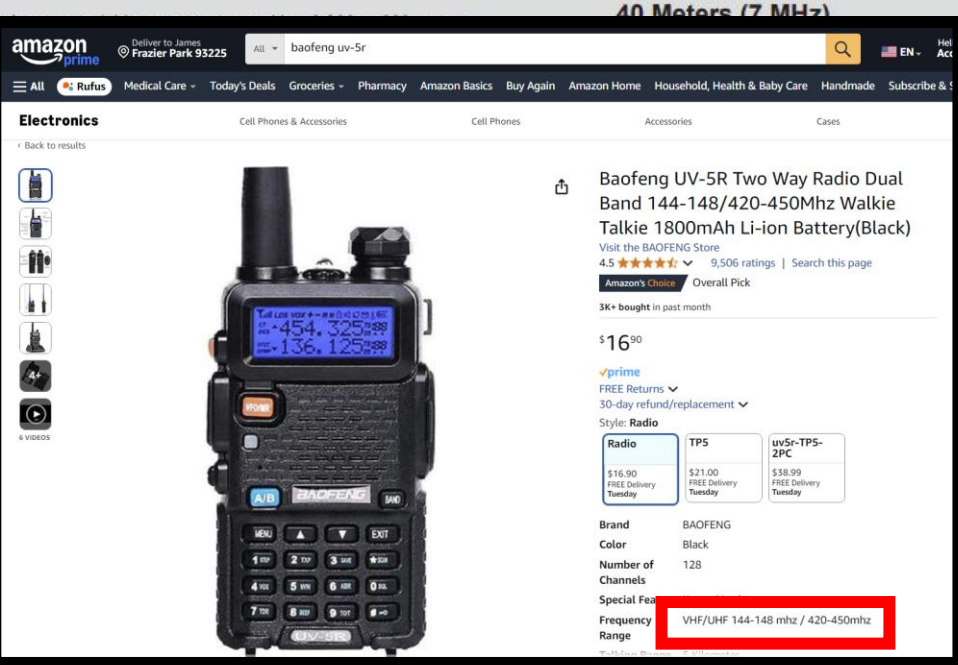
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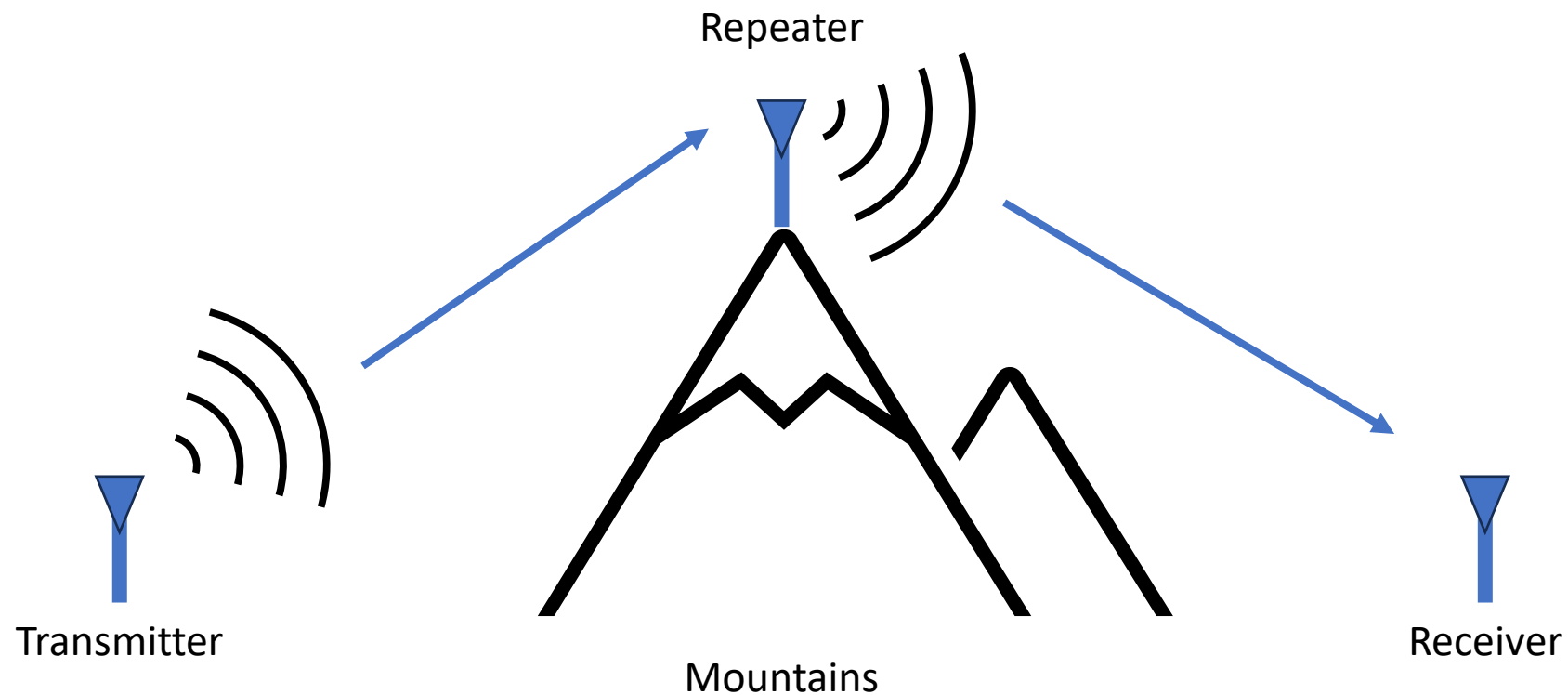
Many handheld radios operate on the 2m, 70cm bands only

The Baofeng UV-5R is a common example

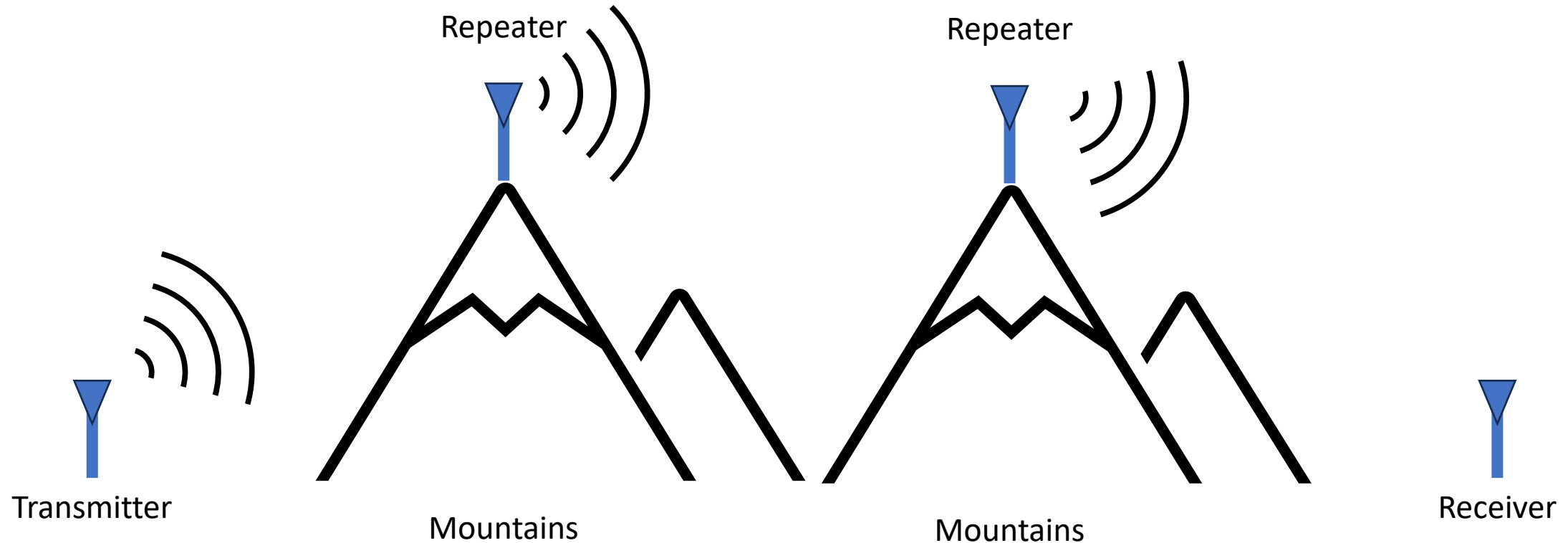
Radios are built to operate on specific bands – important to pay attention to this when purchasing a radio



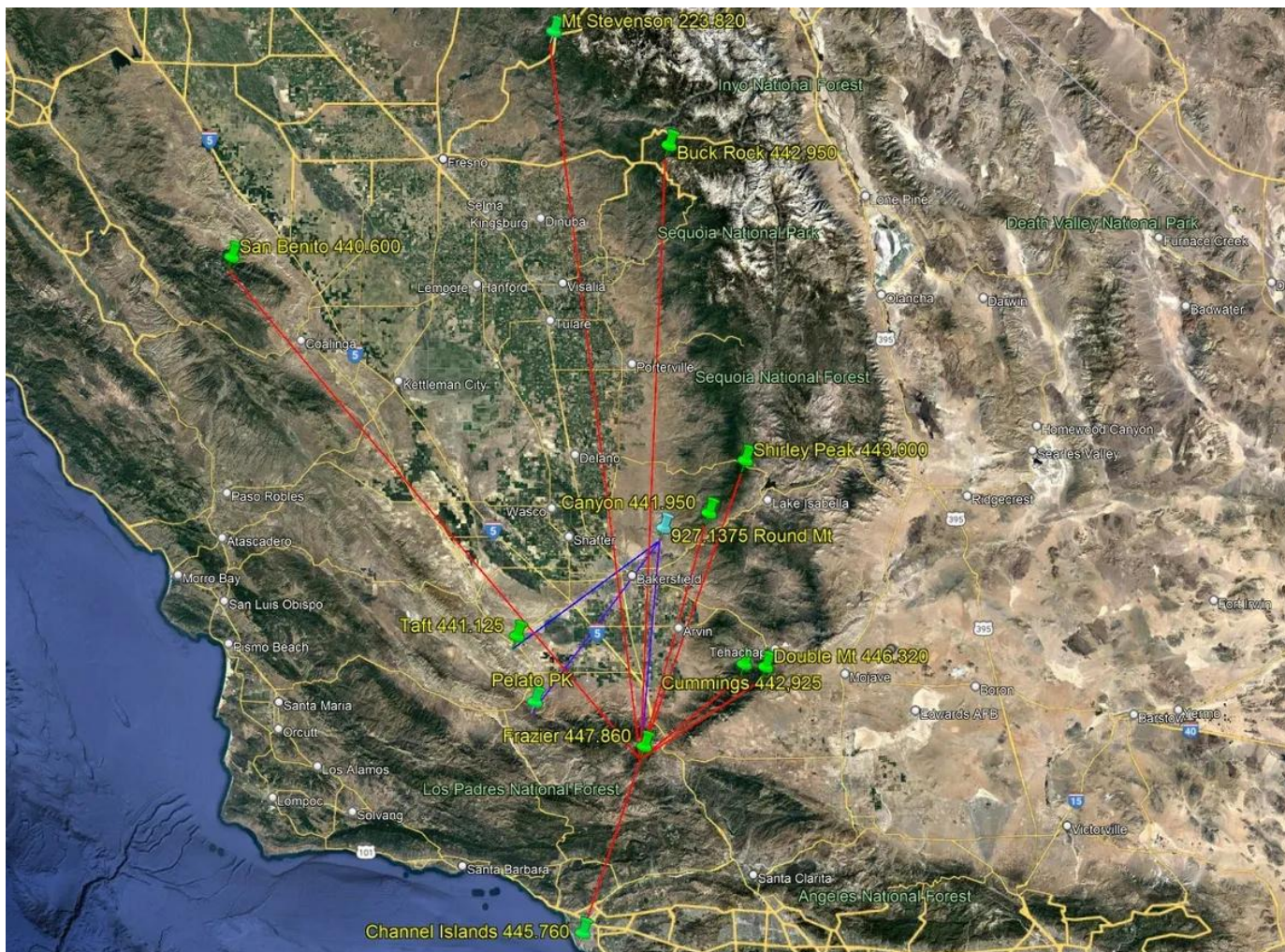
Repeaters and Networks



Repeaters and Networks



Repeaters Near PMC

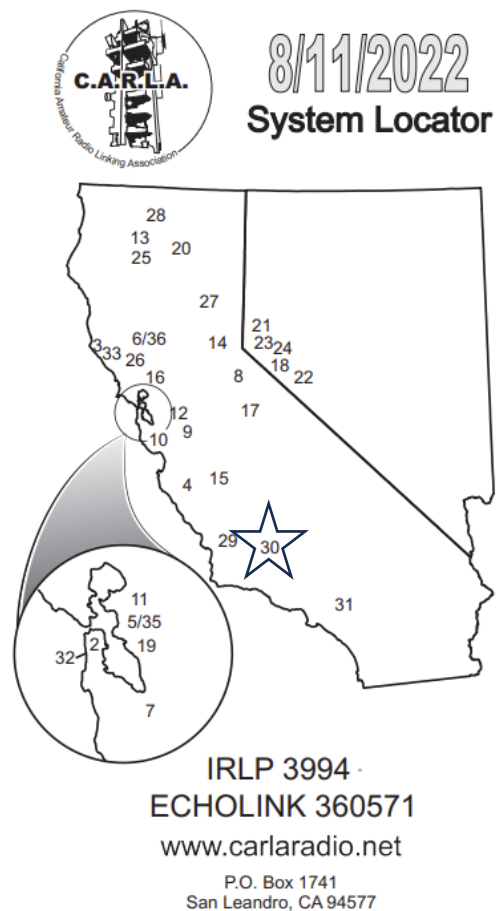


Kern System

- VHF/UHF in Kern County + Ventura
- Centered around Frazier Mtn
- Reception into Santa Clarita+
- <http://kernsystem.org>

KERN – Frazier Mtn is a key way to call
in to PMC in case of disaster







Repeaters Near PMC



Legend

Status →    ← Reserved
On Backup ↕ Special Config

Status Legend

 In Service  Degraded  OOS
 Link Issue  Link Issue  Link Issue

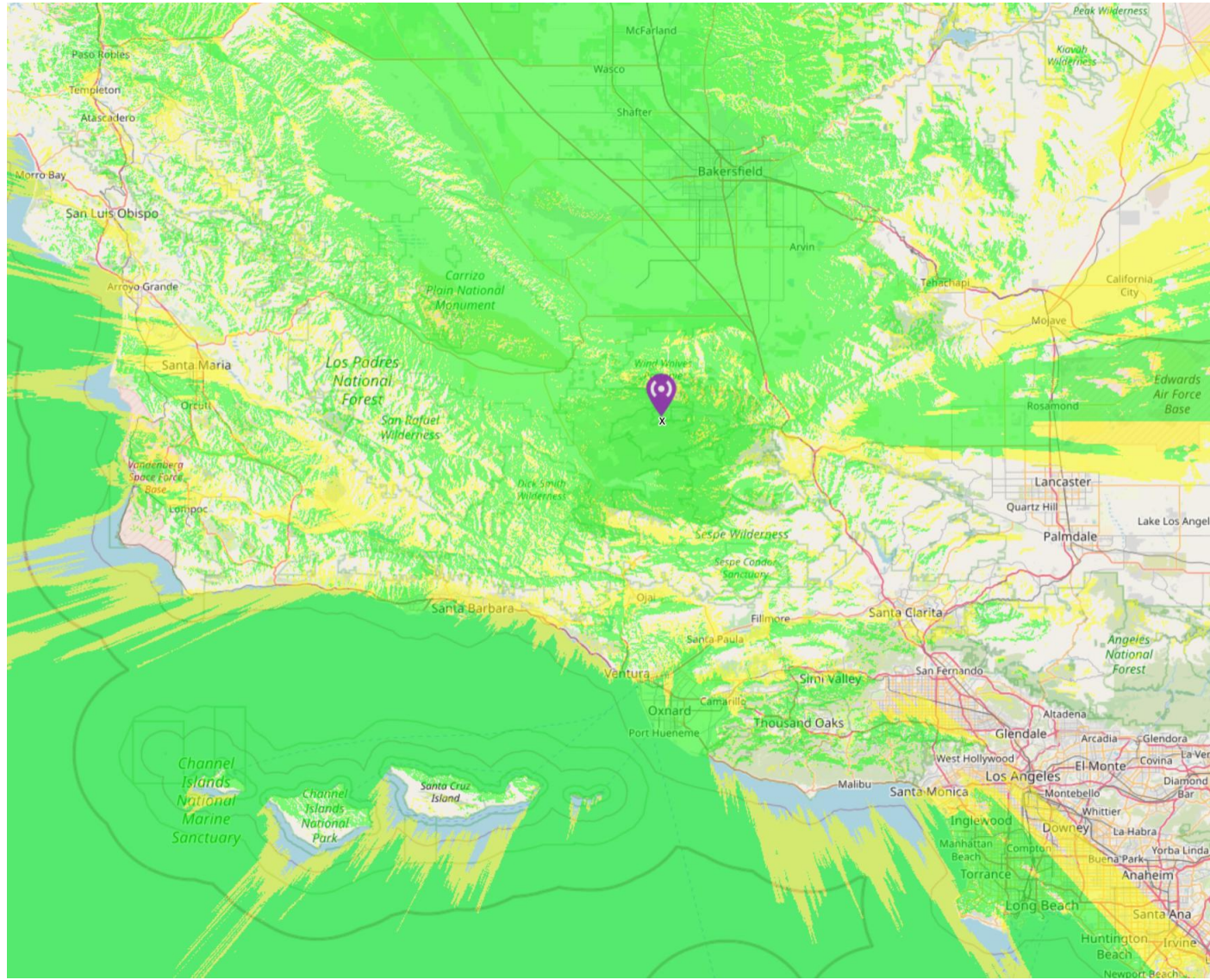
Systems	Freq	Link	Local
2 San Francisco	442.075+	162.2	100.0
3 Pt. Arena	443.075+	173.8	100.0
4 Greenfield	442.075+	167.9	114.8
5 Oakland	443.050+	173.8	114.8
6 Willows	443.075+	167.9	114.8
7 San Jose	443.075+	162.2	123.0
8 South Lake Tahoe	442.075+	151.4	127.3
9 Angels Camp	442.075+	173.8	123.0
10 Monterey Bay	443.475+	173.8	123.0
11 Walnut Creek	443.475+	162.2	114.8
12 Pleasanton	442.075+	156.7	103.5
13 Shasta Lake	442.075+	167.9	114.8
14 Cisco Grove	443.475+	156.7	100.0
15 Fresno	440.750+	162.2	114.8
16 Sacramento	440.750+	173.8	107.2
17 Sonoma	443.475+	151.4	103.5
18 Topaz Lake	443.475+	167.9	110.9
19 Hayward	443.325+	173.8	114.8
20 Burney	440.750+	156.7	123.0
21 Reno	440.750+	156.7	127.3
22 Hawthorne	440.725+	156.7	127.3
23 North Lake Tahoe	441.550+	156.7	127.3
24 Carson Valley	443.325+	156.7	127.3
25 Redding	444.325+	173.8	100.0
26 Geyserville	443.475+	167.9	110.9
27 Quincy	440.725+	173.8	100.0
28 Mt. Shasta	443.475+	173.8	107.2
29 San Luis Obispo	443.500+	162.2	100.0
30 Bakersfield	444.900+	162.2	127.3
31 Los Angeles	448.080-	162.2	88.5
32 Pacifica	440.725+	167.9	114.8
33 Gualala	442.075+	141.3	131.8
35 Oakland	146.850-	162.2	103.5
36 Willows	146.115+	173.8	123.0

CARLA

- California Amateur Repeater Linking Association
- VHF/UHF across CA, NV, OR
- Also has DMR and Echolink nodes
- CARLA System 30 near PMC
- <http://carlaradio.net>

CARLA 30 is a key way to call in to PMC
in case of disaster

Repeaters Near PMC



KC6WRD

- Operated by a PMC resident
- Our local ham repeater!

KC6WRD is a key way to call in to PMC
in case of disaster

What Makes Ham Radio Different?

- There are many unlicensed radio services available (FRS, CB, etc.)
 - GMRS is limited, but has more privileges than FRS
 - 30 channels on 1 band (462-467 MHz)
 - Low power limits (2W/5W/50W) limit range
 - Mostly voice, some (limited) data allowed
- Amateur Radio is very flexible...
 - Fewer restrictions
 - More frequencies (channels or bands)
 - More power (to improve range and quality)
 - More ways to communicate
 - It's **FREE** to operate your radio!

With More Privileges Comes More Responsibility

- Ham Radios are much more capable and have the potential of interfering with other radio services
- Ham radios have unlimited reach, they easily reach around the globe and into space
- FCC authorization is required to ensure the operator is qualified to operate safely, legally and appropriately – this is why you are here

License Test Areas

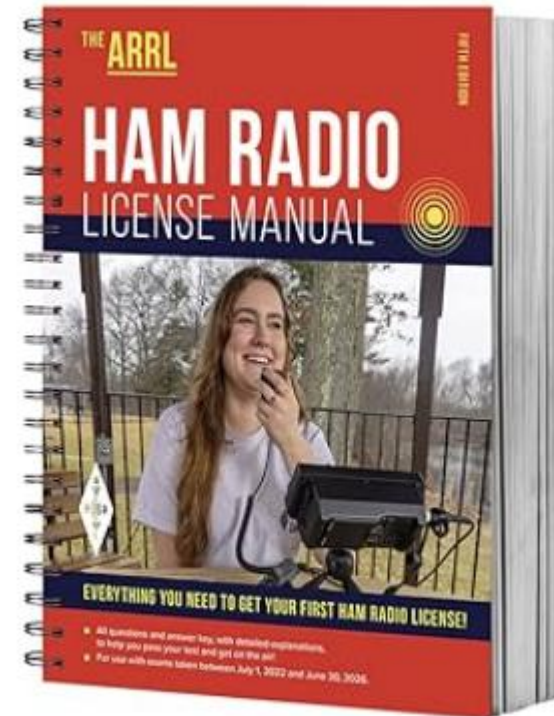
- Radio signals and modulation
- Electricity, components and circuits
- Antennas and propagation
- Radio equipment
- Radio operation
- Regulations
- Safety
- *Each license grade covers the same material, in more detail*

Technician Test Format

- 35 questions, randomly picked from a pool of 300
 - Pool available online: <https://www.arrl.org/question-pools>
- To pass, get 26 questions correct (74%)
- Multiple choice
- Calculators are allowed (but not really needed)
- Test is proctored by several volunteer examiners
- Can be taken online or in person
 - *Clubs in LA, Bakersfield, Tehachapi offer testing in person*

Study Aids: ARRL License Manual

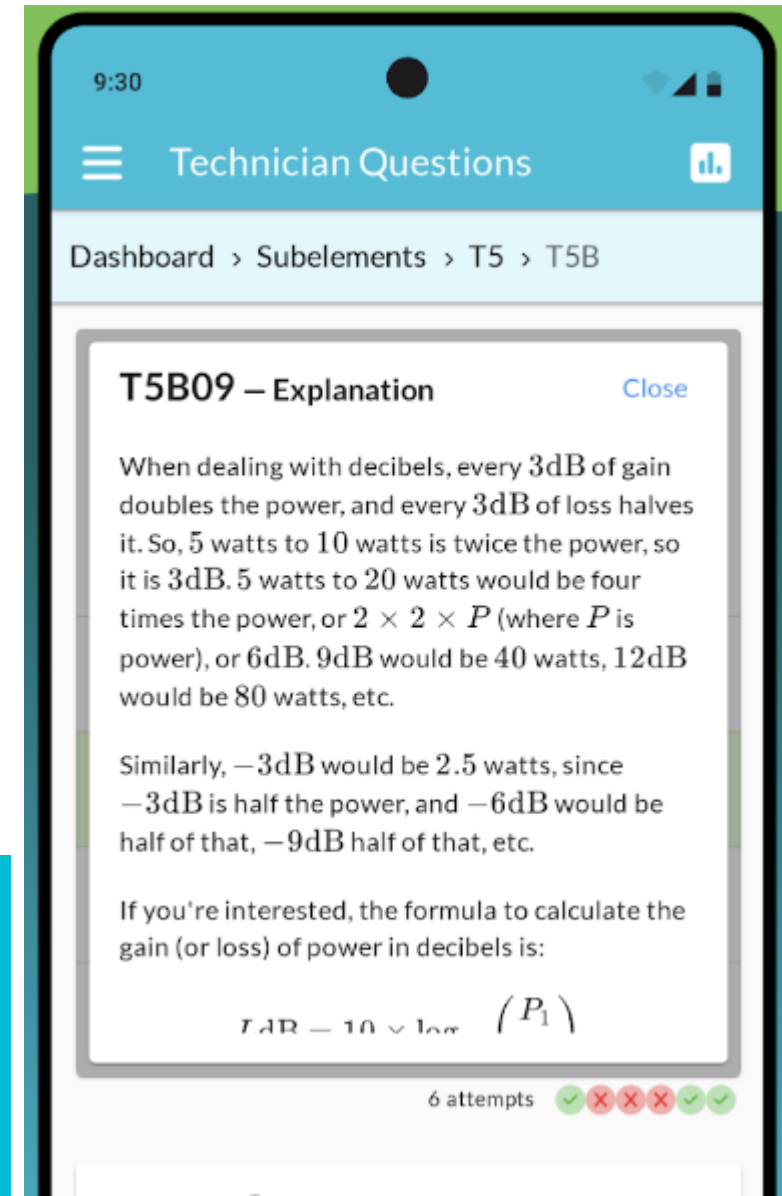
- Recommended: ARRL License Manual
 - ~\$35
 - Includes complete question pool
- New edition in 2022
 - Make sure you have the 5th edition
- Additional resources available online
 - <https://www.arrl.org/ham-radio-license-manual>



We'll be following the ARRL License manual, but other books are also great!

Study Aids: Digital Tools

- Websites with practice tests:
 - Eham.net, hamexam.org, arrl.org
- Apps
 - HamTech+ (iOS)
 - HamStudy (Android)
- Youtube
 - Ham Radio Crash Course
- Additional online resources
 - <https://hambook.org/>
 - <https://newhams.info/>



The Plan for This 6-Week Class

Our objective: prepare you to take the Technician amateur radio license exam!

- Feb 9 Welcome to Amateur Radio!
- Feb 16 Radio Fundamentals & Electricity, Components and Circuits
- Feb 23 Licensing Regulations & Operating Regulations
- Mar 2 Ham Equipment & Communicating With Other Hams
- Mar 9 Propagation, Antennas, Feedlines & Safety
- Mar 16 Preparing for the Exam & Review

Next Week

- Sunday, Feb. 16, noon-1pm
- Topics:
 - **Radio Fundamentals & Electricity** (ARRL Chapter 2)
 - **Electricity, Components and Circuits** (ARRL Chapter 3)
- Please read about these topics
 - We have a few books we can lend
- Also available
 - Slides to be posted at <https://tinyurl.com/mcarc-intro-to-ham>
 - **Radio Office Hours: Thursdays 7pm-8pm, PMC Condor Room**
 - Email: kk6dzw@arrl.net

Slides adapted from:

- <https://www.arrl.org/instruction-arrl-resources>
- <https://web.stanford.edu/~pauly/AmateurRadio/>

