# Introduction to Amateur Radio

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***Presented by:***

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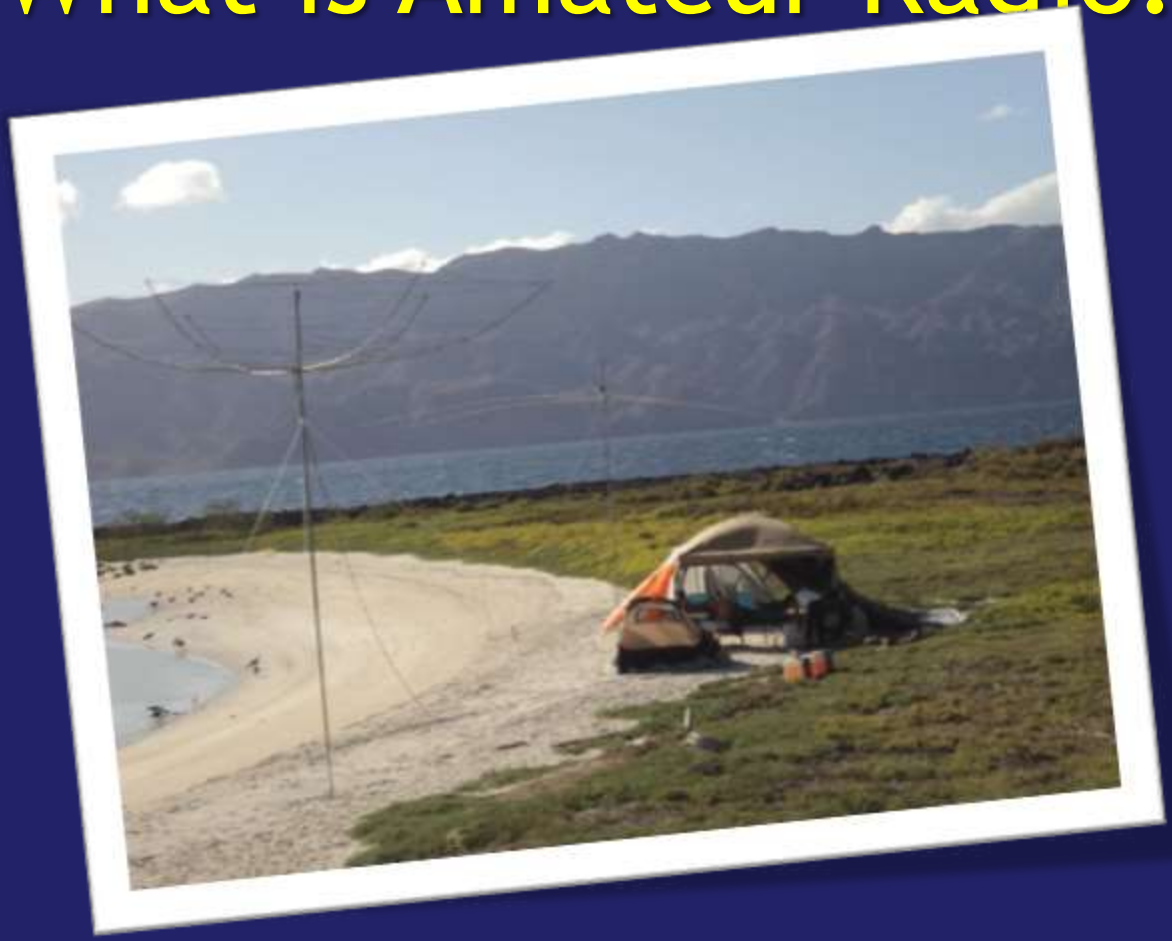
# Syllabus

1. What is Amateur Radio?
2. What Hams do with Amateur Radio
3. How to Become a Radio Amateur
4. Your First Station
5. Why Join a Local Club?

# What is Amateur Radio?



Amateur Radio is a community of people who use radio transmitters and receivers to communicate with other Amateur Radio operators.

# Communicate, Experiment, Interact, Compete

- Amateur radio is a regulated, non-commercial radio service. Unlike other radio services, such as CB or GMRS, hams can transmit with as much as1500 watts PEP. (1.5 Kilowatts)

- Experimentation is not only allowed, but it's encouraged. Ham radio is truly a hobby, but often one that makes a difference especially in emergency or disaster situations. It is an activity of Self-Learning, Inter-Communication, and Technical Investigation.

- Amateurs talk to local friends over the radio waves using hand-held transceivers, communicate digitally using packet, to exchange personal messages, or vital information in an emergency, talk to other hams anywhere in the world, or engage in contests over the airwaves.

- There is truly something for everyone. In the U.S. there are over 700,000 licensed radio amateurs, and this number is steadily increasing.

# What Do Hams Do?


QRP HF VHF Dxing Emcomm Technical
Contesting Satellites Digital SSTV
Space Communications

# QRP

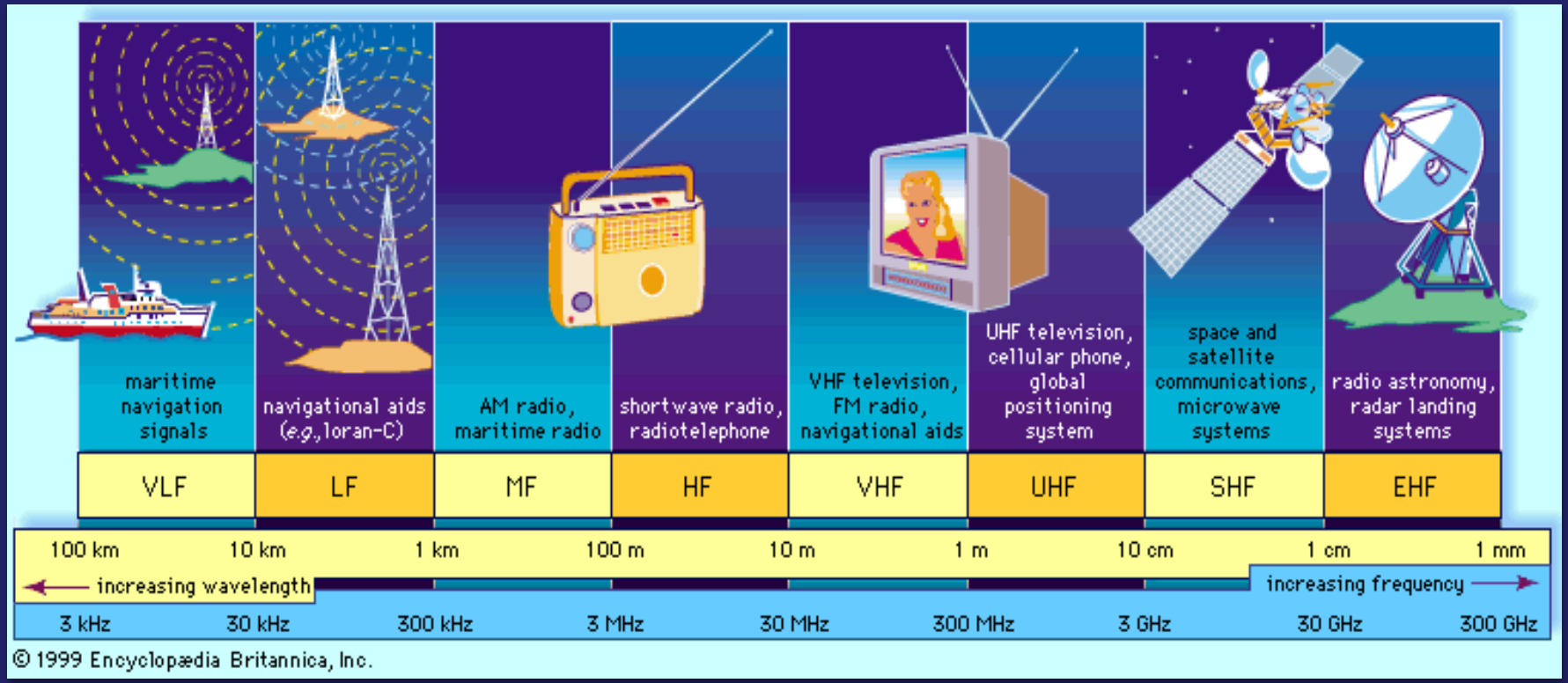
Communicating with ‘very low power’ is a challenge that many hams enjoy.  QRP is usually practiced on the HF bands.

# HF Radio

- Hams can talk to other hams in literally any part of the world using the ‘short waves.’

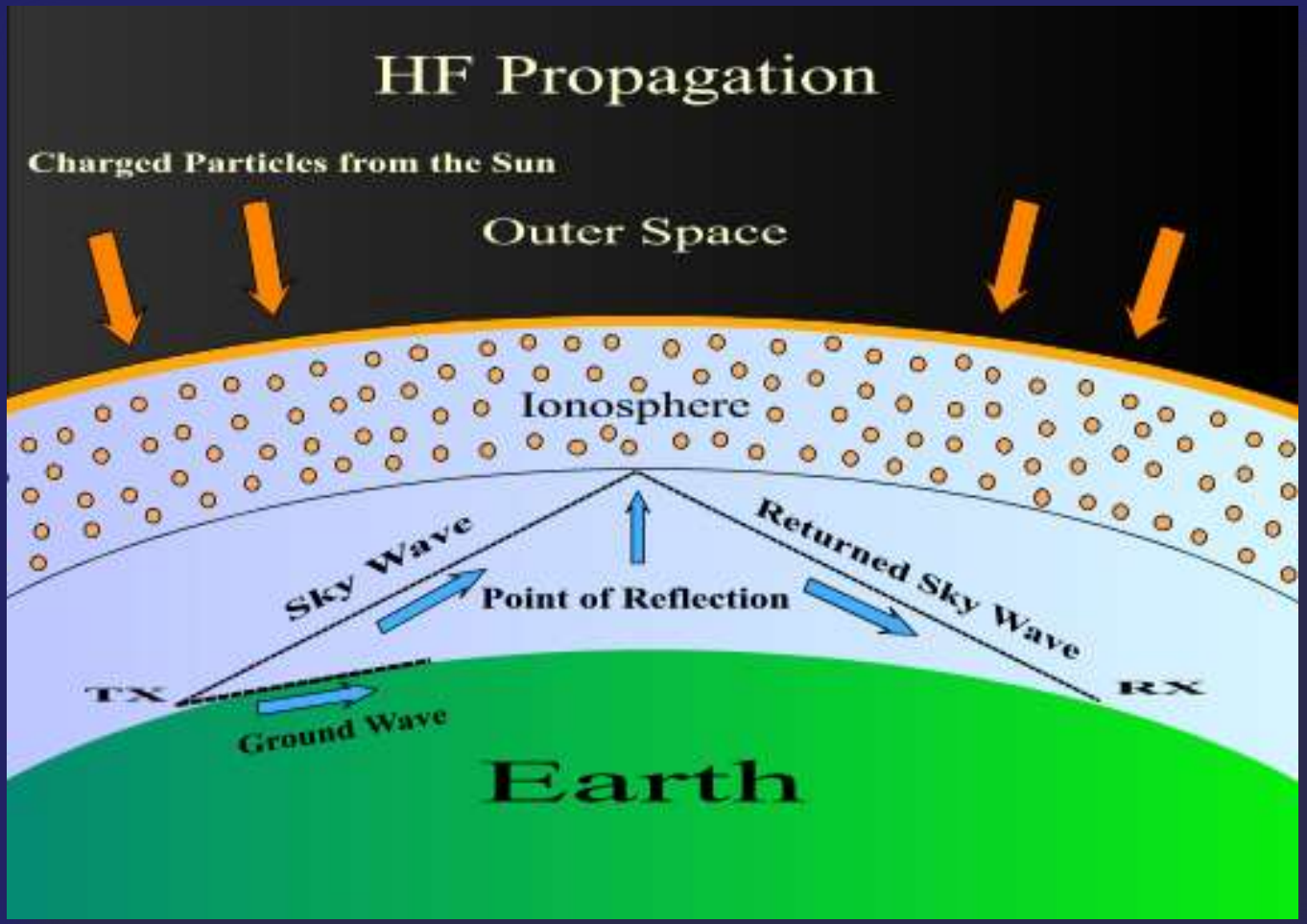
- By bouncing signals off the ionosphere, signals can travel 1000's of  miles.

# The Radio Spectrum

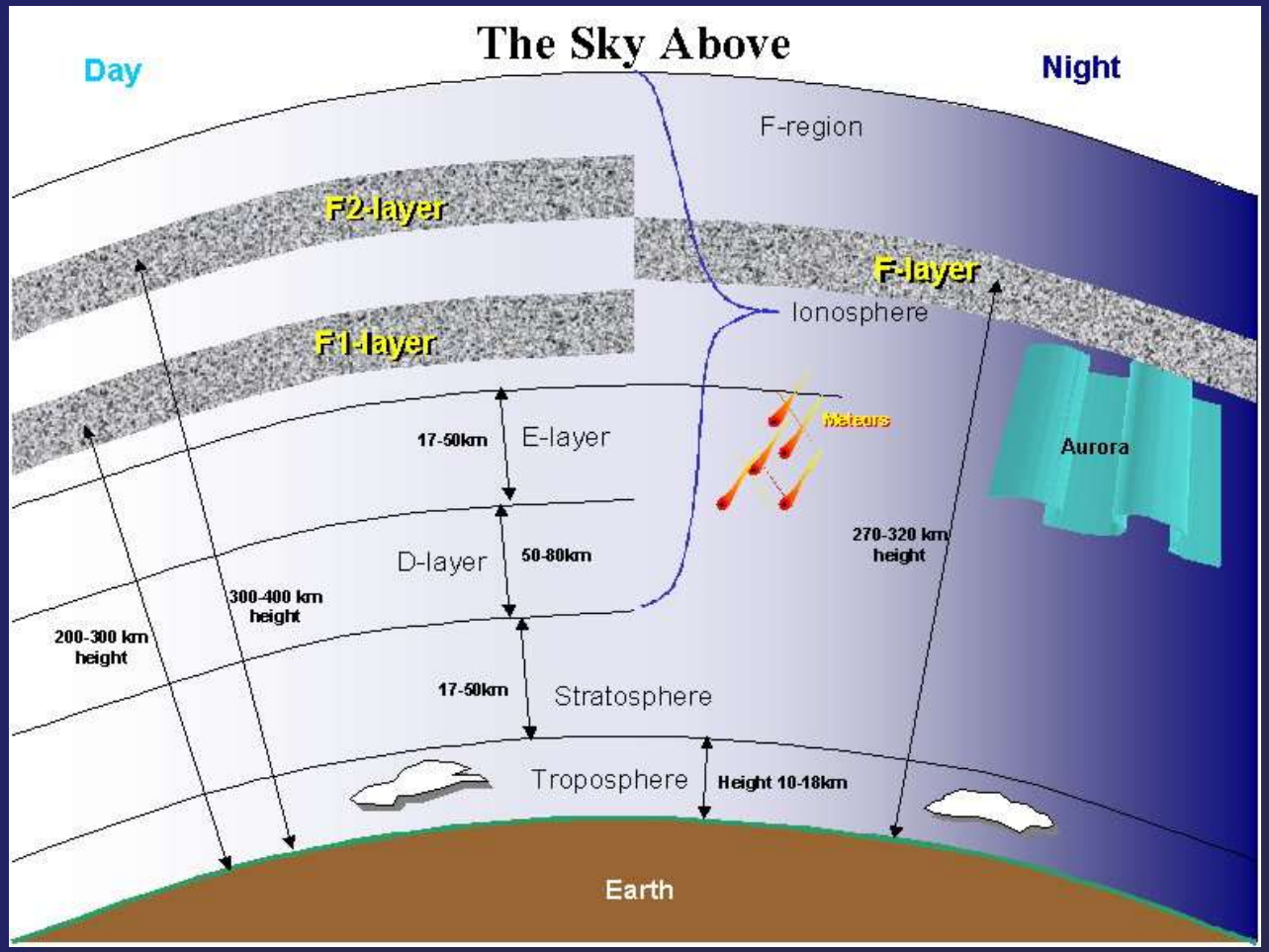



Radio Amateurs have privileges from 160 meters (MF) to the Microwave bands (SHF)

# HF Propagation



# Layers of the Ionosphere



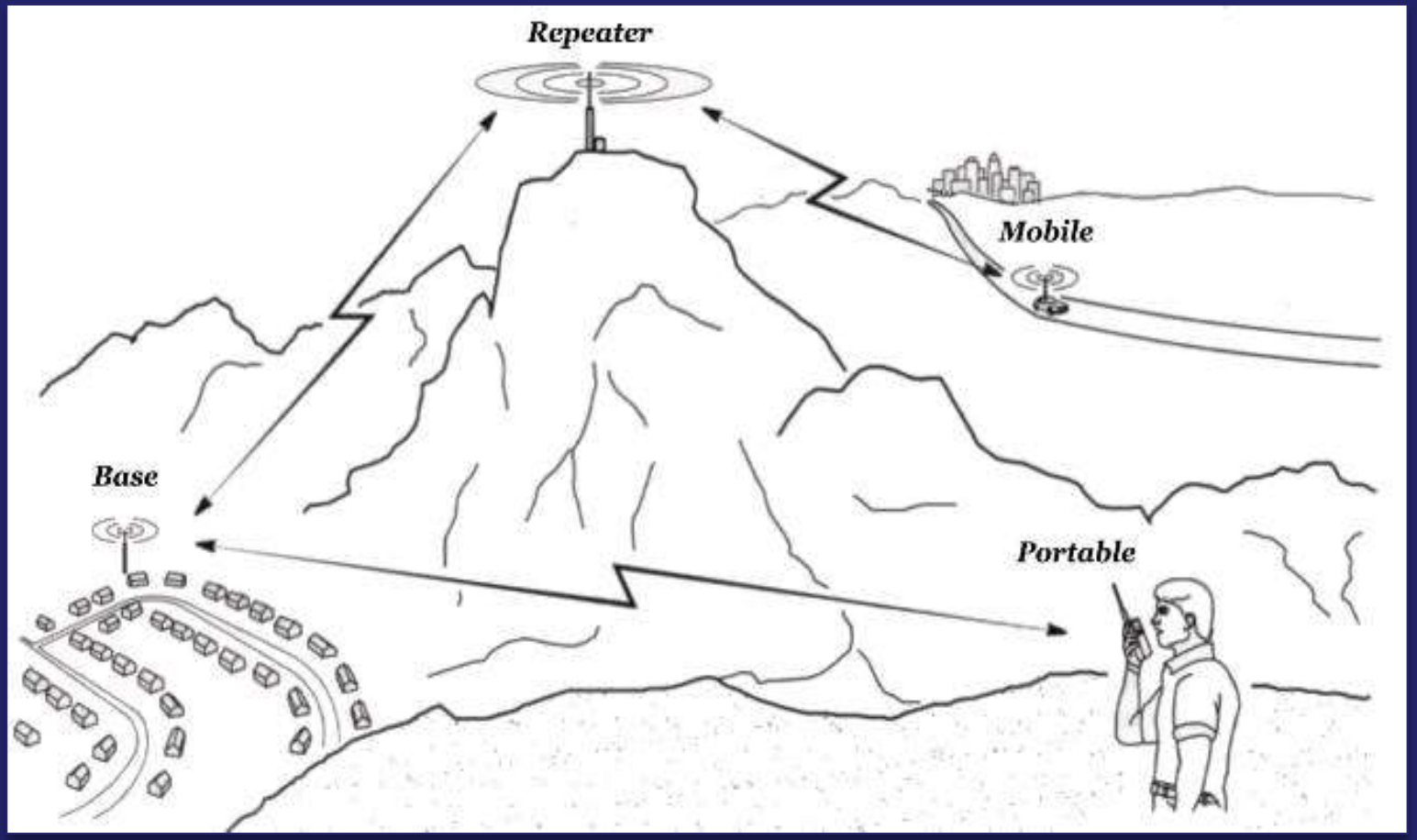
# VHF & UHF

Hams enjoy extremely reliable communications within their local community via simplex communications, or make use of repeaters that can extend the range up to 50 miles or more.

Single-band handheld transceiver (right)

Typical dual-band mobile transceiver (below)


# Repeater vs. Simplex Communication




Repeaters help extend the range of VHF and UHF handheld and mobile transceivers.

# 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.**

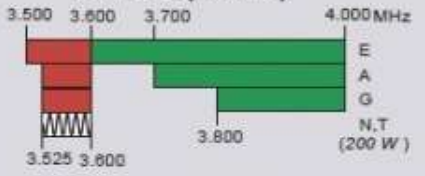
**Effective Date March 5, 2012**

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

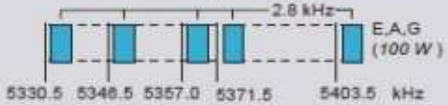
## 160 Meters (1.8 MHz)

Avoid interference to radiolocation operations from 1.900 to 2.000 MHz


## 80 Meters (3.5 MHz)

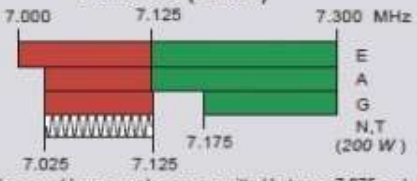



## 60 Meters (5.3 MHz)




General, Advanced, and Amateur Extra licensees may operate on these five channels on a secondary basis with a maximum effective radiated output of 100 W PEP. Permitted operating modes include upper sideband voice (USB), CW, RTTY, PSK31 and other digital modes such as PACTOR III as defined by the FCC Report and Order of November 18, 2011. USB is limited to 2.8 kHz centered on 5332, 5348, 5358.5, 5373 and 5405 kHz. CW and digital emissions must be centered 1.5 kHz above the channel frequencies indicated above. Only one signal at a time is permitted on any channel.

## 40 Meters (7 MHz)

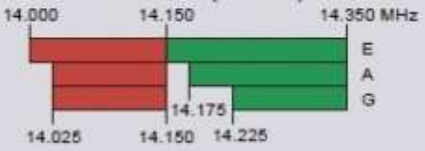



Phone and Image modes are permitted between 7.075 and 7.100 MHz for FCC licensed stations in ITU Regions 1 and 3 and by FCC licensed stations in ITU Region 2 West of 130 degrees West longitude or South of 20 degrees North latitude. See Sections 97.305(c) and 97.307(f)(11).
Novice and Technician licensees outside ITU Region 2 may use CW only between 7.025 and 7.075 MHz and between 7.100 and 7.125 MHz. 7.200 to 7.300 MHz is not available outside ITU Region 2. See Section 97.301(e). These exemptions do not apply to stations in the continental US.

## 30 Meters (10.1 MHz)

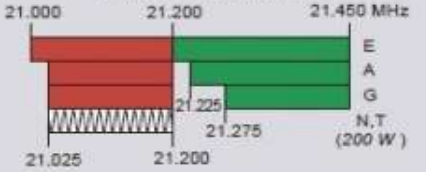
Avoid interference to fixed services outside the US.


## 20 Meters (14 MHz)

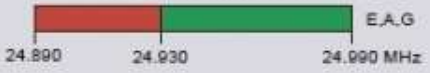



## 17 Meters (18 MHz)


## 15 Meters (21 MHz)




## 12 Meters (24 MHz)




## 10 Meters (28 MHz)


## 6 Meters (50 MHz)

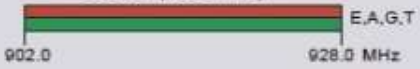

## 2 Meters (144 MHz)


## 1.25 Meters (222 MHz)

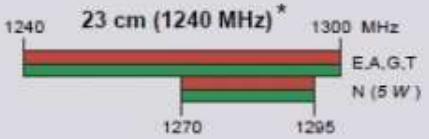

*Geographical and power restrictions may apply to all bands above 420 MHz. See *The ARRL Operating Manual* for information about your area.

## 70 cm (420 MHz)*


## 33 cm (902 MHz)*




## 23 cm (1240 MHz)*




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 |
| 3300-3500 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 *ARRLWeb at www.arrl.org* for detailed band plans.

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 rev. 4/12/2012

# Dxing

DX means distance communication, and with the right equipment, worldwide communication on the HF bands (10 through 160 meters) is a regular possibility.

Many DXers like to contact stations on rare islands and countries which aren't frequently present on the airwaves. This is sometimes called 'chasing DX'


# Emergency and Other Volunteer Services

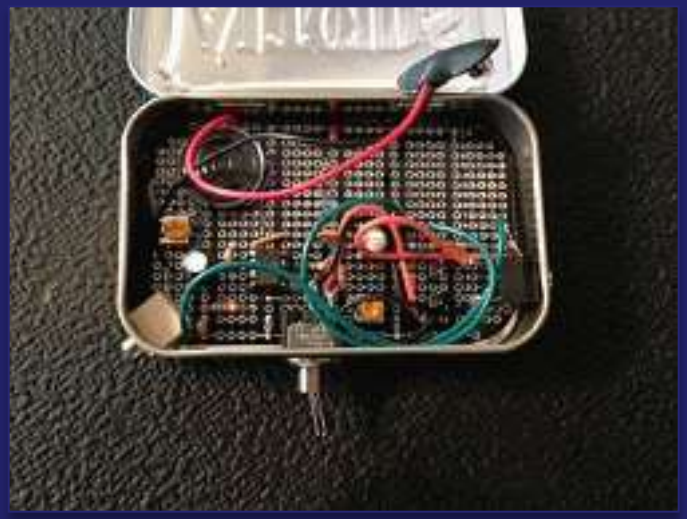
Floods, landslides, earthquakes, hurricanes, accidents (Rail / Road / Air), etc.

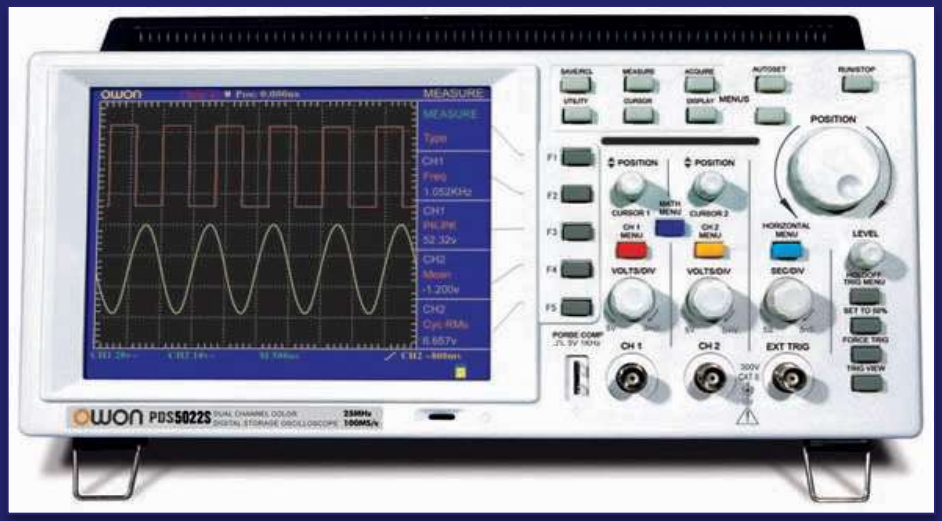
Whenever regular communications fail, hams are ready to use their radios to provide emergency communication services to their communities.



# Technical Experimenting & Kit Building

Hams come from all walks of life, ranging from technicians to engineers, teachers to scientists, and students to retirees.  For many of them, the attraction to the hobby is to build their own equipment whether it is just a simple antenna, something as complex as a transmitter, or an interface between their radio and a computer.





# Contesting

Contesting is often called the ‘sport’ of ham radio. Almost every weekend there is some form of amateur radio contest. Hams get on the air and compete to see who can make the most contacts in a limited period of time.

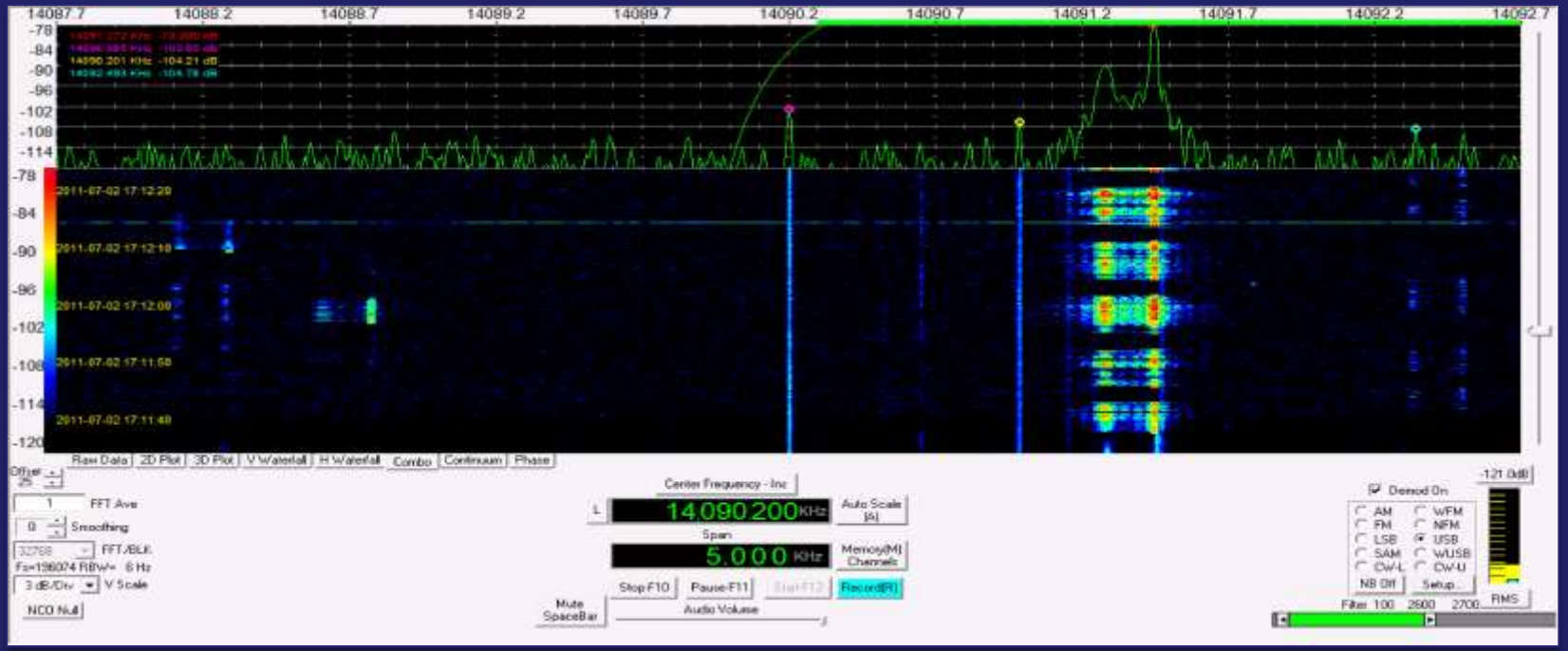
You can put your radio skills up against other hams and teams of hams.


# Talk to Astronauts

Yes, it is really possible. Space stations do have ham radio equipment and licensed ham astronauts often take the time to make contacts with amateurs on earth. Hams also can use satellites as ‘repeaters in the sky’ to make contacts with other earth stations over great distances.

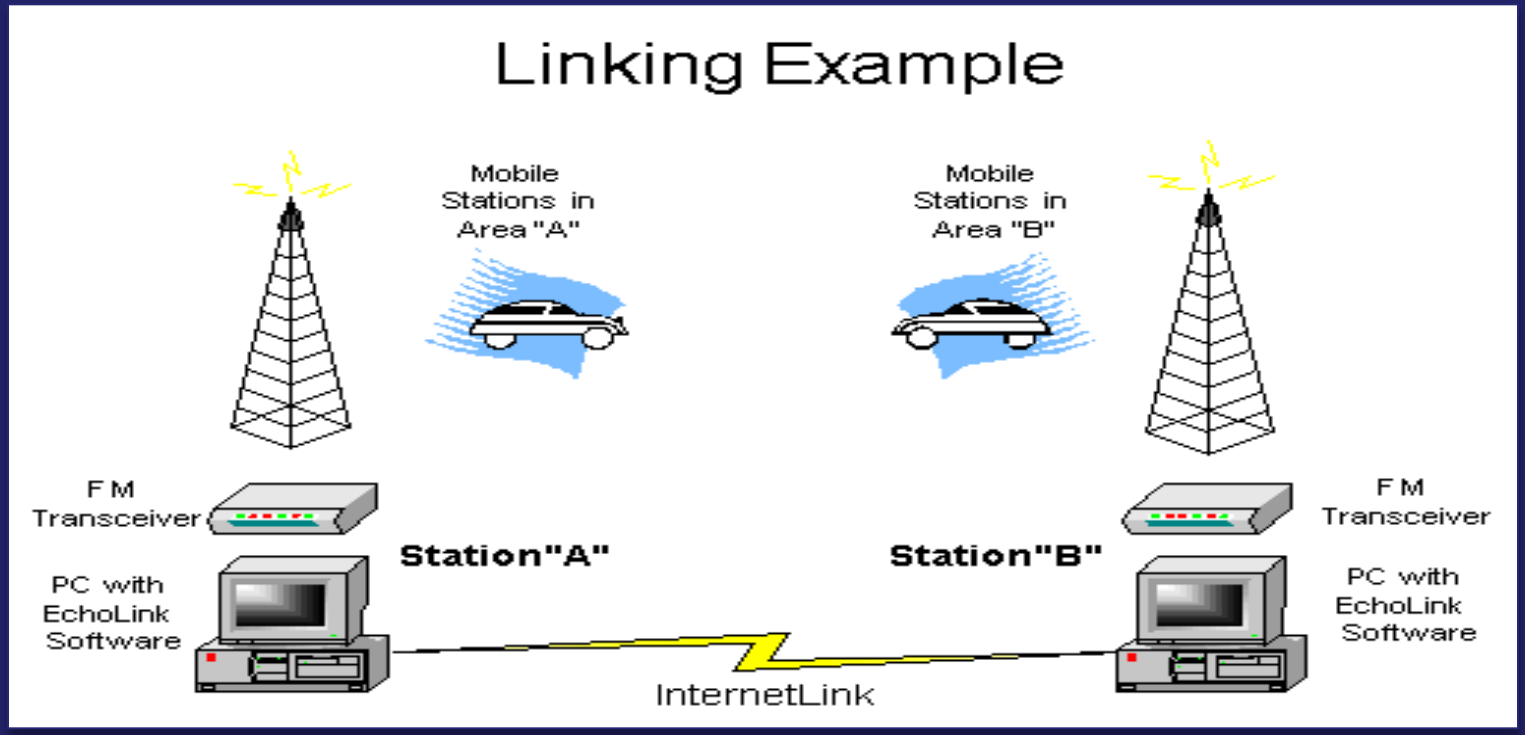
# Digital Communication

Connect a computer to your radio and install some software and you can be communicating digitally over the air. Some of these digital modes can be more effective in marginal transmission conditions and some even sport error free transmission, using methods of Forward Error Correction.



# Internet Communication

Using some of the latest technologies, hams can supplement a modest station with Internet connections. Using features such as D-STAR, Echolink, or IRLP on a local repeater, a ham in Maine can talk to one in Vancouver or even Australia using a simple hand-held transceiver.



# Slow Scan Television

Using a PC with specialized software, you can send pictures around the world.

# Satellite Communications

Amateur Radio satellites use specially allocated frequencies to facilitate communication between amateur radio stations.

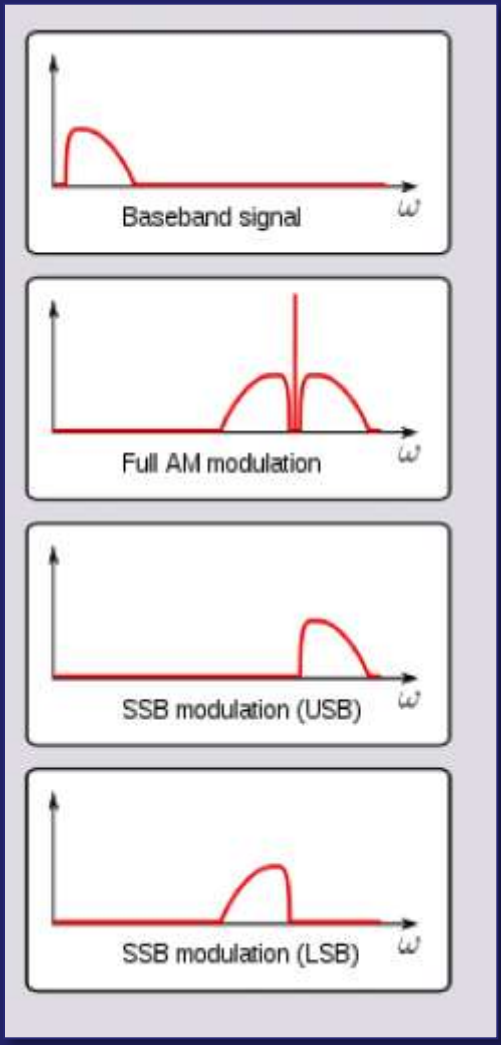
These satellites can be used for free by licensed amateur radio operators for voice and data communications.  Currently, satellites in orbit act as repeaters, linear transponders, or store and forward digital relays.

# Morse Code (CW)

Morse Code is the original digital mode. It's a method of transmitting text as a series of on-off tones that can be directly understood by a skilled listener. The code consists of sequences of short and long signals called 'dits' and 'dahs' which represent all 26 Roman letters, as well as numbers, punctuation, and prosigns.

Though no longer required for licensing in most countries, "CW" or continuous wave is still a popular operating mode among amateur radio operators today. Many consider it to be the language of ham radio.

# Modes of Communication




**Continuous Wave (CW) -** A wave of constant amplitude and frequency. Morse code is transmitted by this means when a carrier wave is switched on and off.

**Amplitude Modulation (AM) -** AM works by varying the strength of the transmitted signal in relation to information being sent. Power is concentrated on the carrier frequency and two adjacent sidebands.

**Single Sideband (SSB) -** A refinement of Amplitude Modulation, that more efficiently uses transmitter power and bandwidth by suppressing the carrier and concentrating power to a single sideband. SSB has become the standard for long distance voice communications.

# Modes of Communication (cont'd)

**Frequency Modulation (FM) -** Frequency modulation conveys information over a carrier wave by varying its instantaneous frequency. This is the popular mode of voice communication in the VHF and UHF amateur bands, as well as most utility and public service radios. Wide (bandwidth) FM is the standard for commercial broadcasters in the North American 88-108 MHz band.

**Frequency Shift Keying (FSK)** - a frequency modulation scheme in which digital information is transmitted through discrete frequency changes of a carrier wave. The simplest form uses a pair of discrete frequencies to transmit binary (0s and 1s) information. An example would be the digital mode, MFSK-16

**Phase Shift Keying (PSK) -** a digital modulation scheme that conveys data by changing or modifying the phase of a carrier wave. An example would be the popular digital mode, PSK-31.

# Amateur Radio Direction Finding (ARDF)


Radio Direction Finding has many purposes, both practical and fun. It can be used to track down interference, assist in search and rescue, find hidden transmitters in a fox hunt, or even track animals that have been equipped with radio transmitting devices.

In some places, ARDF competitions are organized, which awards those who can locate hidden transmitters the fastest. This specialized skill combines knowledge of radio signals and orienteering.

# Going Mobile

Operating while mobile is one of the most popular ways hams communicate. A typical mobile setup includes a 50W VHF / UHF transceiver connected to a vertical mag-mount antenna.

Some take it to the extreme, however, and install a full fledged mobile setup, including multi-band antennas and even tuners.

# Base Station

A typical base station for HF consists of a power supply, transceiver, antenna tuner, amplifier, and if you choose to use digital modes, a PC interface. A variety of antennas can be used, and these depend on band, available space, and preference.

# Antennas

Wire Dipole

HF Yagi

(left) Multi-band HF Vertical

(top) VHF Mobile Antenna

# How to Become a Radio Amateur

The government regulatory agency that issues Amateur Radio licenses in Canada is Industry Canada.

To earn your initial license, you must pass a 100 question multiple choice examination that covers topics such as:

- ***Radio and Electronic Fundamentals***
- ***Operating Station Equipment***
- ***How to Communicate with Other Hams***
- ***Licensing Regulations***
- ***Operating Regulations***
- ***Electrical and RF Safety***

# License Classes

*In Canada there are two license levels (Three really…). Each one builds upon the previous and offers more privileges.*

- **Basic** - Your first Amateur Radio license offers privileges on VHF, UHF, and the microwaves. The intent of the exam is to affirm understanding of rules, station components, basic electronics, and how to operate in accordance with good engineering and amateur practice.

- **Basic with Honours** - offers HF bands, which allow for regular international communications on the short wave frequencies (between 160-10m).

- **Advanced** - This is the highest level Amateur Radio license and has an extensive focus on radio theory, advanced electronics, operating modes, radio wave propagation, etc. It allows you to build Radios, Repeater systems, and operate at up to 1.5 kilowatt.

# Resources


Canadian Amateur Radio
Basic Qualification
Study Guide


Canadian Amateur Radio Advanced
Qualification Study Guide

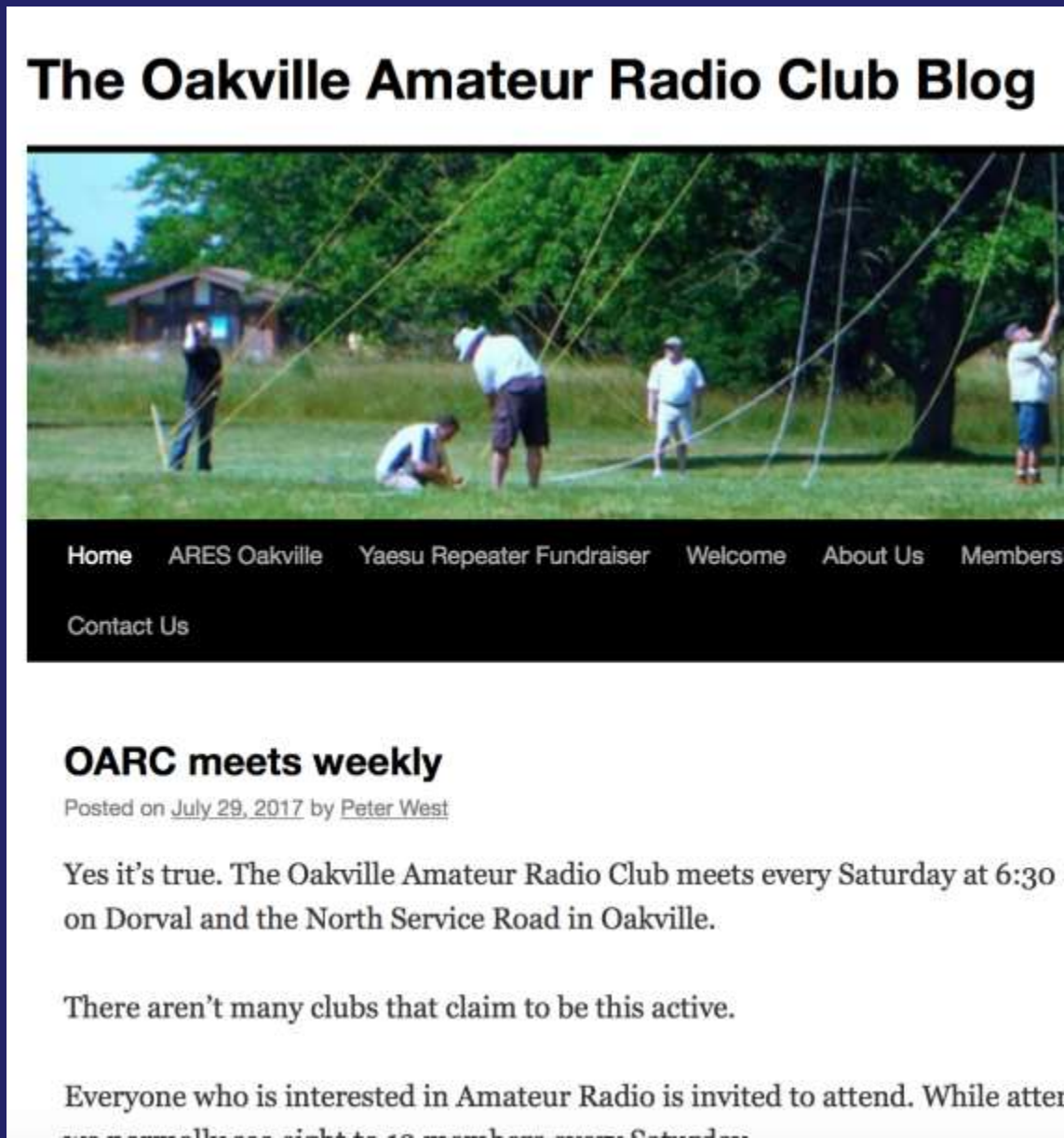
# What do I need to get on the air?


To get started, all you need is a hand-held transceiver. These come in several varieties and cost as little as $59. Most common are single band 2 meter or 70 cm transceivers, or dual band. Some high end models may include additional bands such as 6 meters (50 MHz), 1.25 meters (220 MHz), or even 33 cm, (902 MHz).

Some of these “handy-talkies” are capable of APRS operation, and include built in TNC’s and GPS units. Others include digital voice and messaging capabilities for use with the D-STAR network.

# Why Join a Local Club?

- ✓ Technical Mentoring (Elmers)
- ✓ Field Day
- ✓ Technical Expertise
- ✓ Events & Activities
- ✓ Education
- ✓ Public Service
- ✓ Competitions

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