

AN INTRODUCTION TO AMATEUR RADIO

Fred Kemmerer, AB1OC

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What will we learn about today?



- What is Amateur Radio and why do people use it?
- How do radio transmitters and receivers send information over the air?
- How do we share the "air" among multiple radio users?
- What is it like to make an Amateur Radio contact?
- How do I get a license to transmit using Amateur Radio?
- What's coming next time?

What is Amateur Radio?

Amateur Radio a hobby for the 21st century

The Radio Society of Great Britain

Link to video

Why Do People Get Involved In Amateur Radio?















Why Do People Get Involved In Amateur Radio?

- It's a way to learn about electronics and how cell phones, Wi-Fi, other wireless gadgets work.
- It provides us with a way to build things and learn how they a put together.
- It lets us provide communications during disasters and emergencies.
- It lets us communicate through satellites and the ISS in space.
- We can learn to locate hidden radio transmitters.
- We get to meet people and make friends around the world.
 - We also learn about geography and cultures in other countries.
- It provides a practical way to use what we've learned about Science, Math, and Technology.

Getting an Amateur Radio license shows that you can accomplish a technical goal and that's good for our college and certain job applications.

How Do Radios Work?



Link to video

How Do Radios Work?

- Q: What two pieces of equipment are needed to send a radio signal over the air and receive it somewhere else?
 - A: A transmitter to send a signal & a receiver to receive it.
- Q: What kind of wave does a radio transmitter use to send information over the air?
 - A: A sine wave.
- Q: What are we doing when we tune our receiver? Why do we need to tune?
 - A: Transmitters transmit their signal only on a specific radio frequency. When we tune our receiver, we can pick the one we want to hear.
- Q: How does a transmitter add information to a radio sine wave so the information is carried over the air?
 - A: By encoding or modulating the information on a radio carrier or sine wave. What are some types of modulation?

Radio Wave Frequency Speak

 Hertz (Hz) – The frequency or rate at which a radio wave goes through a cycle



A radio wave that completes 1 Million Cycles in a second is a 1 Million Hertz radio wave

- We use Kilo, Mega, & Giga with Hz to indicate higher frequencies
 - 1 Kilo-Hertz (KHz) is 1,000 (Thousand) Cycles each second
 - 1 Mega-Hertz (MHz) is 1,000,000 (Million) Cycles each second
 - 1 Giga-Hertz (GHz) is 1,000,000,000 (Billion) Cycles each second
- Frequency Band A range of Frequencies used for a specific purpose
 - Example: The <u>10 Meter Amateur Radio Band</u> is from 28 MHz 29.7 MHz

The Radio Spectrum – How We Share The Air

Frequency Bands and Radio Services



The Radio Spectrum – How We Share The Air

Match These Up

- AM Radio <u>MF</u>
- Wi-Fi <u>UHF & SHF</u>
- FM Radio
 <u>VHF</u>
- Cell Phones <u>UHF & SHF</u>
- Over The Air TV VHF & UHF
- Aircraft and Ships <u>HF</u>
- Satellites
 <u>SHF</u>
- Amateur Radio
- All of these (and more)

Frequency Band Choices MF – Medium Frequencies (300 KHz – 3 MHz) HF – High Frequencies (3 MHz – 30 MHz) VHF – Very High Frequencies (30 MHz – 300 MHz) UHF – Ultra High Freq. (300 MHz – 3 GHz) SHF - Super High Freq. (3 GHz – 30 GHz)



Phonetic Alphabet Good communications in difficult conditions

Phonetic Alphabet

- B Bravo O Oscar
- C Charlie P Papa
- D Delta
- F Foxtrot S Sierra
- H Hotel
- I India
- K Kilo
- L Lima
- M Mike

- A Alpha N November

 - Q Quebec
- E Echo R Romeo
- G Golf T Tango
 - U Uniform
 - V Victor
- J Juliet W- Whiskey
 - X X-ray
 - Y Yankee
 - Z Zulu



- **Call Signs** ٠
 - AC1DC Alpha Charlie **One Delta Charlie**
 - MORCN Mike Zero Radio Charlie November
- Names ٠
 - Jamey Juliet Alpha • Mike Echo Yankee
- Can you spell your first name using the Phonetic Alphabet?

Putting It All Together

A Real Amateur Radio Contact

Link to Video



- Amateur Radio Operators have call signs to identify themselves. Fred's is AB1OC.
- What frequency are we using for our contact?
- What country in the world is the other station located and what is their call sign?

Getting an Amateur Radio License

- You need an FCC license to operate an Amateur Radio Transmitter. Its easy to get a License.
- Three Levels of Licenses are available
 - **Technician** Local and Space communications on VHF and above bands at limited power.
 - **General** Communicate around the World using HF bands. Full access to all Amateur Radio bands with some frequency restrictions at full legal power.
 - Extra Access to all available Amateur Radio bands and frequencies at full legal power
- Must pass a multiple-choice questions test covering rules and regulations, radio station operation, antennas, and some electronics
 - Questions and answers are published
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 - The Nashua Area Radio Society offers classes
 - Preparation involves studying a license book
 - Hams like me will administer and grade your exam





Questions?

Contact Information:

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Much more information, pictures and video are available on our Blog at:

stationproject.blog

and on the Nashua Area Radio Society's website at:

www.n1fd.org

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AMATEUR RADIO ON THE HF BANDS

Fred Kemmerer, AB1OC

What will we learn about today?



- Where are the Amateur Radio HF Bands located in the Radio Spectrum we learned about last time?
- We'll learn some of the special language that Amateur Radio operators use on the air.
- Where in the world can we communicate using the **HF Bands**?
- What is a **DX Station** and how do we contact a rare DX station?
- What is **Radio Propagation** and how does it enable us to communicate around the world?

The Radio Spectrum – How We Share The Air

Frequency Bands and Radio Services



Phonetic Alphabet Good communications in difficult conditions

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- Names ٠
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The Language of Amateur Radio

Q-Signals and Shorthand



- CQ I am calling anyone who can hear me and wants to communicate
 - DX Distant Contacts (not in the USA)
 - What might CQ DX mean?
- Signal reports "You Are 59"
 - First number is readability: **2 You are barely understandable**
 - 5 It's like you are in the room with me
 - Second number is signal strength: We get this from the *S-Meter* on our Radio
 - 9 and above is very strong
 - 7 is pretty good
 - 5 is OK and will usually provide decent audio
 - Less than 5 is weak and may be hard to understand
- Q-Signals are the universal Amateur Radio shorthand
 - QSL Do you understand? I understand.
 - **QSB** There is fading on your signal.
 - **QRM** Another station is interfering with you.
 - **QRT** I am going off the air
 - **73** Goodbye, best wishes.

Let's Listen Again A Real Amateur Radio Contact

Link to Video



- How did AB1OC call CQ?
- What were the signal reports that were sent by AB1OC and MORCN?
- What other **Q-signals** were used and what did they mean?

The Language of Amateur Radio

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Where Are Hams Around The World? Who can we talk to?

Link to Video



- The video shows contacts made from our station here in New Hampshire.
- Each Red star is a different Amateur Radio Station.
- What parts of the world have the most Ham Radio Stations?
- What parts of the world would be the most interesting to talk to?

Working DX Stations Communicating with the World





Baker Island

2018 Commemorative DXpedition



- There are 340 DXCC entities, some are in remote, uninhabited places
- Hams can earn an operating award for working (talking to) and confirming 100
- All Hams want to "work them all" at least once
- Many are on only once every 10 to 15 years
- What do you think is the most wanted DXCC in the world right now?

A DXpedition – Activating a Rare Island A Pileup – Many Stations Calling



- What was the call sign of the DX station, why was this station so popular?
- What is unique about the frequencies being used by the stations in the pileup?
- Make a list of all the stations that call the DX.
- What was the minimum information that each station gave the DX?

A DXpedition – Activating a Rare Island

- Q: What was the DX Station's Callsign?
 - A: <u>VP2ELY</u> A DXpedition to <u>Anguilla</u>



- Q: Why was the station so popular?
 - A: They were on a DXpedition to activate <u>Anguilla</u>, a rare DXCC entity (a rare island)
- Q: Who were the stations that called the DX? What was the minimum information exchanged?
 - A: W7CCY, KG6MC, AB1A, N2SG, AB1OC All United States stations. A call sign & signal report are required for a valid contact.

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How Do Radio Signals Travel So Far? Its All About Propagation

• Normally, radio waves can only travel a little further along the ground than we can see.



- The Ionosphere has several layers that come and go during daylight and at night.
- The number of sunspots determines how well each layer reflects radio waves.
- More sunspots allows us to reflect higher frequency radio waves.
- Lower frequencies are absorbed and blocked by the lower layers (D region) during the daytime.



 We can bounce our signals off the high layers in the earth's atmosphere (the lonosphere) and the ground to make our radio waves travel further.



What Do We Know About Radio Propagation?

- Q: How far can radio waves travel along the ground?
 - A: Only a little further that we can see.
- Q: How do we make our radio waves travel around the world?
 - A: By bouncing them off the lonosphere and the ground.
- Q: What determines how well we can reflect radio waves using the upper layers of the atmosphere?
 - A: The number of sunspots on the sun.
- Q: What do we need to reflect higher frequency radio waves?
 - A: More sunspots.
- Q: What layer of the lonosphere absorbs lower frequency radio waves and prevents them from propagating?
 - A: The D layer during the daytime.

What Does a Typical HF Radio Station Look Like?



- Gear that is part of a typical station includes
 - A 100W Transceiver & Power Supply A computer for logging and digital
 - A Wire Antenna

- A Headset with a Microphone
- Useful additional gear can include
 - A set of paddles for Morse Code
 - Amplified Speakers

- A second Monitor for the Computer
 - An Antenna Tuner and SWR Monitor

Basic HF Radio Station What is needed?

- An HF Transceiver with a power supply
- Headset (headphones and microphone)
- A simple antenna made from wire
- Coax cable to connect the Transceiver and the antennas
- A computer to work digital modes and keep track of contacts
- A key for sending Morse Code









Buckmaster OCF Antenna Suggested Configuration



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Amateur Radio – Part II

What Comes Next?



- Digital Operating & Computers
 - Communicating with Hams Around the World with a small station
 - Using Computers & Software in Ham Radio
- Space Communications
 - Amateur Satellites
 - Communicating with Astronauts on the International Space Station



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AB1OC Virtual Station Tour

- Antennas
 - Main Tower
 - Satellite Tower
 - EME Tower
- Shack

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- Shack Tour
- <u>Satellite Station</u>
- Space Comms Area (EME)
- Amateur Television
- <u>Remote (Internet) Operating Gateway</u>
- Mobile HF Station







Questions?

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