

Exploring the HF Bands

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What You Need to Get There,
What To Do Once You Are There,
and
Some Useful Operating Tips

The HF Bands

- As Technicians you learned the Radio frequency spectrum was divided into “bands”, based on their characteristics.
- You’ve probably operated on the VHF (Very High Frequency) and the UHF (Ultra HF) bands (2 meters and 70 cm), and perhaps the Technician section of the 10 meter band.

The HF Bands

- Generally, the bands from 160 meters (1.8 to 2 MHz) through 10 meters (28 to 29.7 MHz) are collectively referred to as the HF (High Frequency) bands.
- There are two other bands that will soon become available to US Hams, the 600 meter band (472 to 479 KHz) – just below the AM broadcast band, and
- The 2200 meter band (135.7 to 137.8 KHz).

Getting on HF

- Basically, you will need three things to operate on HF:
 - The privileges (which hopefully you will have at the end of this class),
 - An HF antenna,
 - And an HF rig (transceiver).
- However, there are some other items that you'll find useful:

Getting on HF

- A suitable length of coax to connect your antenna to your radio.



Getting on HF

- A grounding system and lightning arrester.



Getting on HF

- An SWR meter – to help protect your radio and to alert you when something has happened to your antenna.



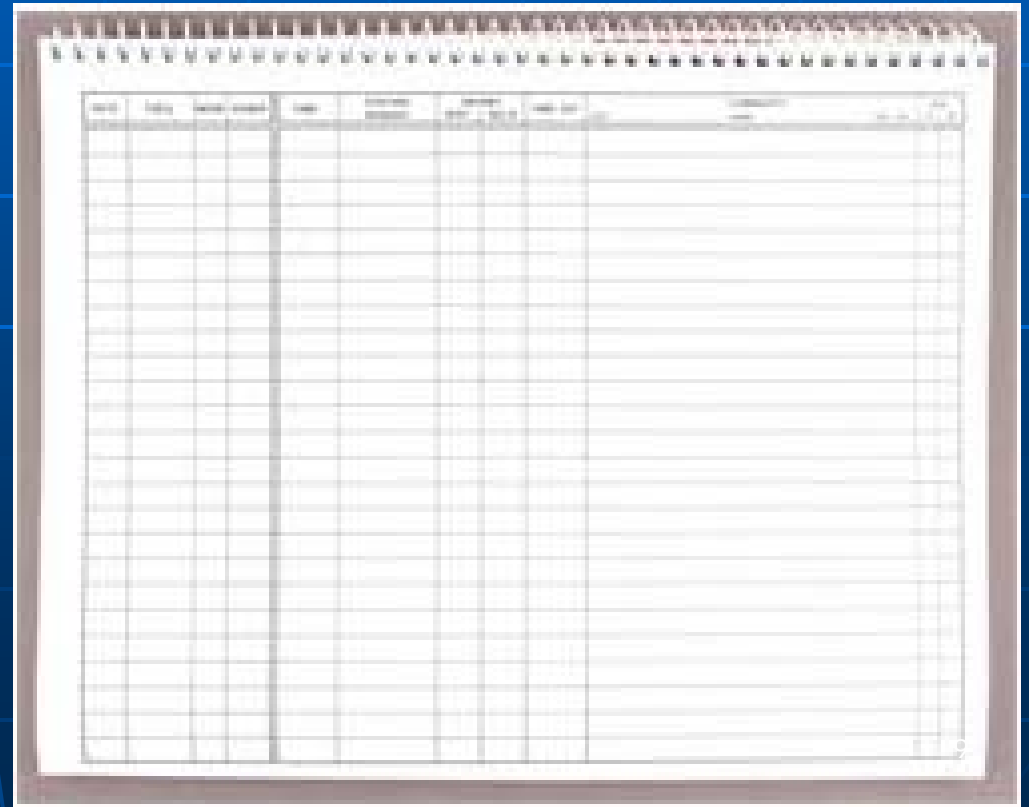
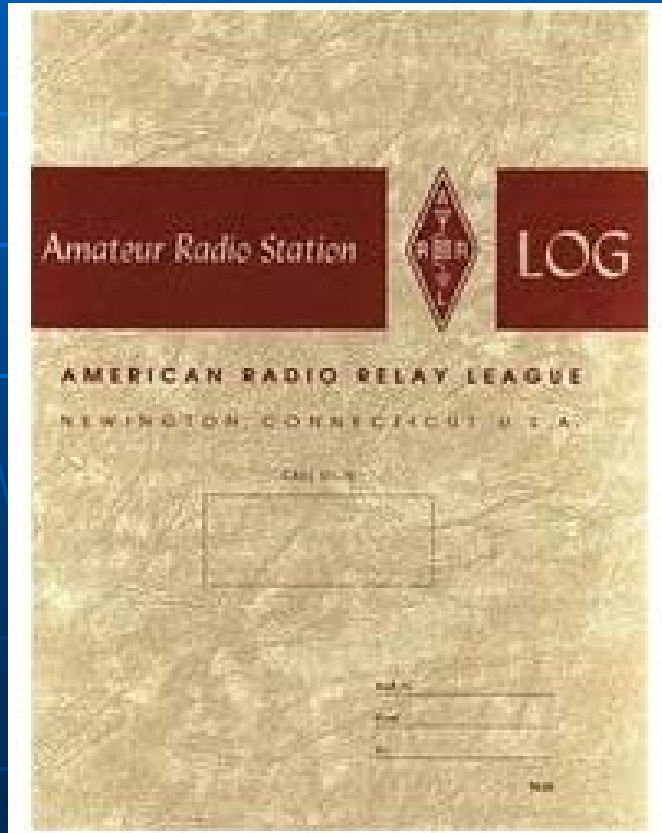
Getting on HF

- An easier to use SWR meter.



Getting on HF

- A log – either paper or electronic.



Getting on HF

- A place to put your station that is somewhat secluded. You want to avoid background noise and interruptions.



Getting on HF

- Some hams have portable stations.



Getting on HF

- Of course, some hams do get a bit carried away.



Getting on HF

- And some of them go completely over the edge!



A Bit of History

- As radio development evolved, individual experimenters were forced to give way to commercial users.
- The powers that be (the Government and Business interests) had realized the value of the radio spectrum.
- The need for more spectrum (and higher power) pushed the development away from wideband inefficient spark gap transmitters to narrow band high power AM transmitters.
- It was commonly believed that the lower frequencies were best for long distance transmissions.
- Ham radio operators got pushed higher and higher in frequency, and by 1920, were not permitted below 200 meters (about 1.5 MHz).

A Bit of History

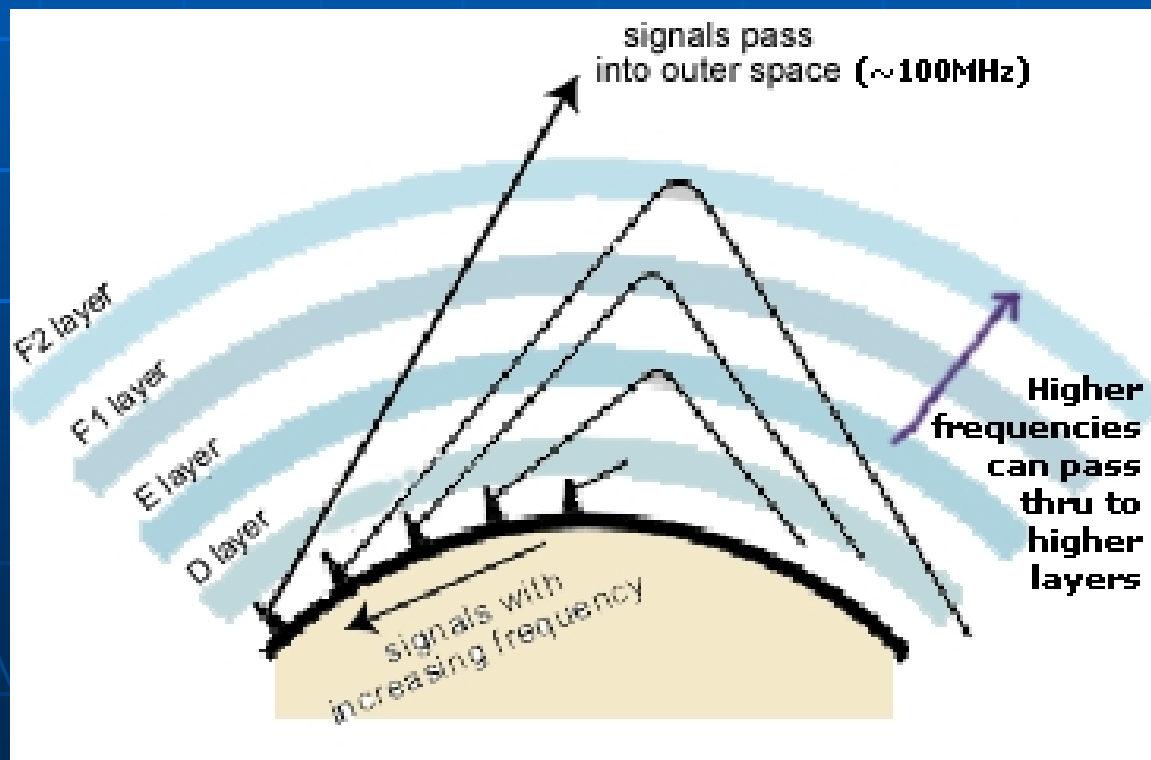
- As always, Hams started experimenting in this vast RF waste land they were consigned to and strange things started happening.
- The radio waves were not behaving as anticipated.
- In fact, as they generated higher and higher frequency signals, they being received further away than physics deemed possible.
- It just didn't make sense . . .

A Bit of History

- Until in 1924 a British researcher named Edward Appleton confirmed a prediction made in 1902 by researchers Arthur Kennelly and Oliver Heaviside.
- Kennelly and Heaviside predicted reflective layer of charged particles up in the atmosphere that very efficiently reflect certain radio frequencies.
- Today the general term for these reflective layers (yes, there are several of them) are called the ionosphere.

A Bit of History

- This meant that under the right conditions, certain radio signals could bounce off the ionosphere and the earth multiple times, enabling communications around the world.



HF Today

- As this potential was recognized, the powers that be took most of this “vast wasteland” of RF spectrum away from hams, leaving them with small windows or bands throughout the HF spectrum (roughly 1 to 50 MHz).
- These windows are the HF bands called 160, 80/75, 60, 40, 30, 17, 15, 12, and 10 meters.
- You will want to get an Amateur Radio Band Chart and post it near your radio.

HF Today

US Amateur Radio Bands

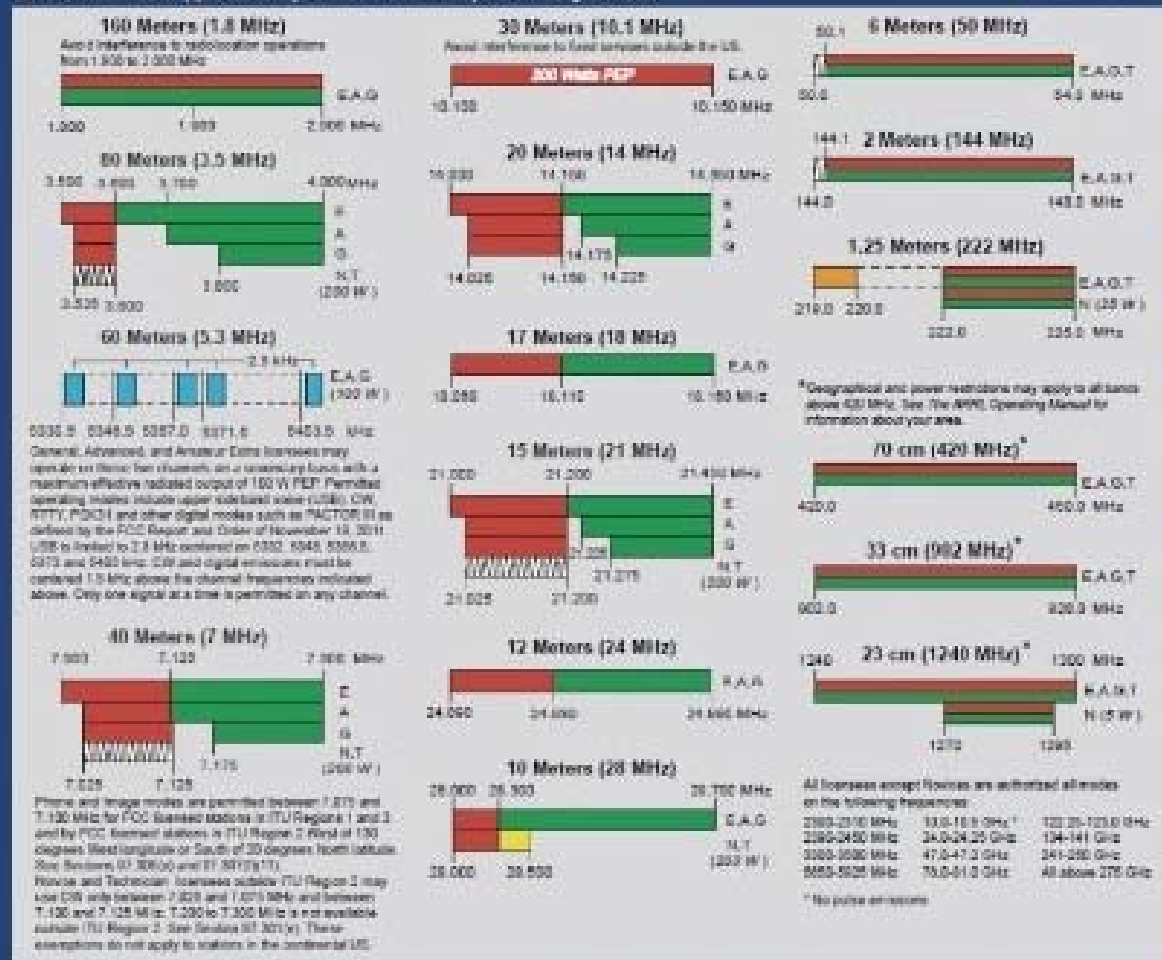
US AMATEUR POWER LIMITS

FCC §73.313. An amateur station must use the minimum transmitter power necessary to carry out its desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

Effective Date
March 5, 2012

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KEY

Note:
CW operation is permitted throughout all amateur bands.

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

Fixed frequencies are authorized above 21 MHz, except for 219-220 MHz.

- = RTTY and data
- = phone and image
- = CW only
- = 2000 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 for more information on detailed band plans.

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HF Today

- Make sure it's current, and use it to keep from go into areas you are not permitted.

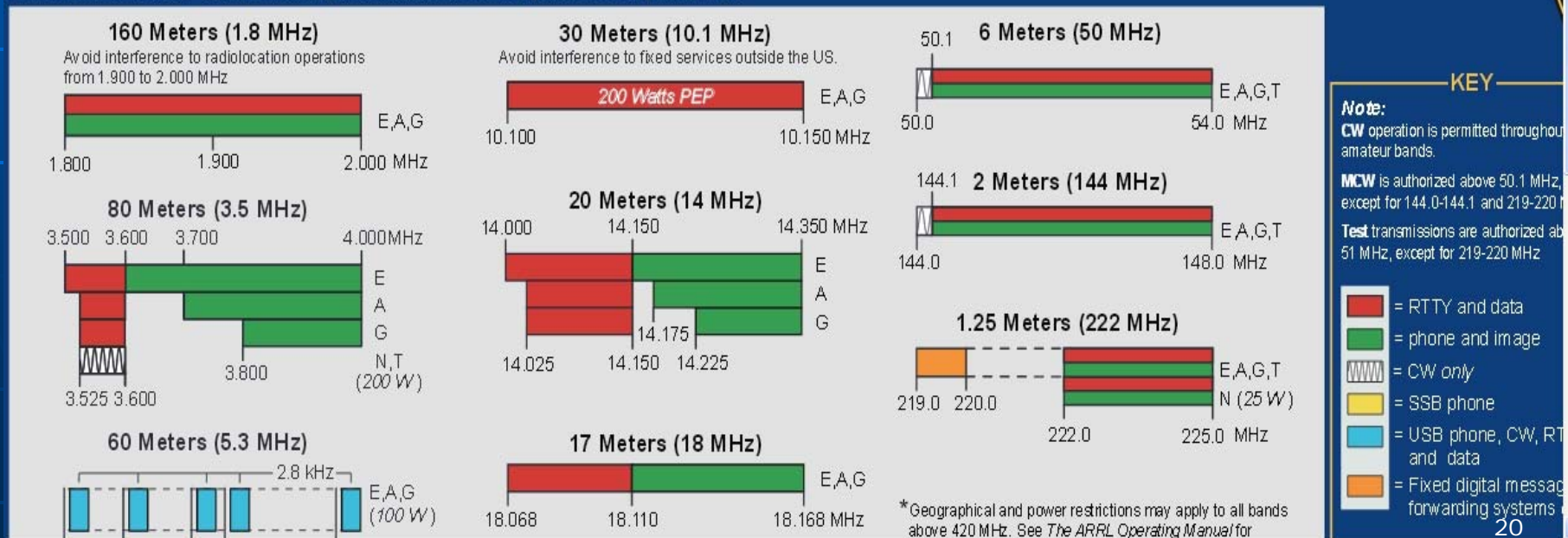
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HF Today

- However, beyond the Band Chart is a subdivision of most bands called a band plan.
- Each band has a band plan.
- It includes not only FCC rules, but it also
- Reflects a “gentleman's agreement” on what types of signals should be seen in what part of each band.

HF Today

160 Meters (1.8-2.0 MHz)

1.800 - 2.000	CW
1.800 - 1.810	Digital Modes
1.810	CW QRP
1.843-2.000	SSB, SSTV and other wideband modes
1.910	SSB QRP
1.995 - 2.000	Experimental
1.999 - 2.000	Beacons

80 Meters (3.5-4.0 MHz)

3.590	RTTY/Data DX
3.570-3.600	RTTY/Data
3.790-3.800	DX window
3.845	SSTV
3.885	AM calling frequency

HF Today

60 Meters (5 MHz channels)

*Only one signal at a time is permitted on any channel

*Maximum effective radiated output is 100 W PEP

5330.5	USB phone ¹ and CW/RTTY/data ²
5346.5	USB phone ¹ and CW/RTTY/data ²
5357.0	USB phone ¹ and CW/RTTY/data ²
5371.5	USB phone ¹ and CW/RTTY/data ²
5403.5	USB phone ¹ and CW/RTTY/data ²

1. USB is limited to 2.8 kHz

2. CW and digital emissions must be centered 1.5 kHz above the channel frequencies indicated in the above chart

HF Today

40 Meters (7.0-7.3 MHz)

7.040	RTTY/Data DX
7.080-7.125	RTTY/Data
7.171	SSTV
7.290	AM calling frequency

30 Meters (10.1-10.15 MHz)

10.130-10.140	RTTY
10.140-10.150	Packet

HF Today

20 Meters (14.0-14.35 MHz)

14.070-14.095	RTTY
14.095-14.0995	Packet
14.100	NCDXF Beacons
14.1005-14.112	Packet
14.230	SSTV
14.286	AM calling frequency

HF Today

17 Meters (18.068-18.168 MHz)

18.100-18.105	RTTY
18.105-18.110	Packet

15 Meters (21.0-21.45 MHz)

21.070-21.110	RTTY/Data
21.340	SSTV

12 Meters (24.89-24.99 MHz)

24.920-24.925	RTTY
24.925-24.930	Packet

HF Today

10 Meters (28-29.7 MHz)

28.000-28.070	CW
28.070-28.150	RTTY
28.150-28.190	CW
28.200-28.300	Beacons
28.300-29.300	Phone
28.680	SSTV
29.000-29.200	AM
29.300-29.510	Satellite Downlinks
29.520-29.590	Repeater Inputs
29.600	FM Simplex
29.610-29.700	Repeater Outputs

HF Antennas

- The standing joke goes: "Look up antenna in a dictionary and it will say "see: compromise""
- Antennas are compromises between almost 25 separate factors including:
- Cost, ease of installation, covenants and deed restrictions, efficiency, radiation pattern, polarization, take off angle, available space, single or multiple band capabilities, and even your S.A.F. (Spousal Acceptance Factor).

HF Antennas

- If you've got the room, (and neighbors and your spouse will tolerate it), wire antennas are a good start.
- They are easy to put up using a sling shot, a weight, and some fishing line.
- Simple wire antennas can be made with wire, insulators (PVC works), rope (use weather resistant paracord) and trees for support.
- You will probably want a multiband antenna, so look into G5RV, OCF, and Fan Dipoles.
- If you have only one attachment point (besides your house) consider an end fed antenna.

HF Antennas

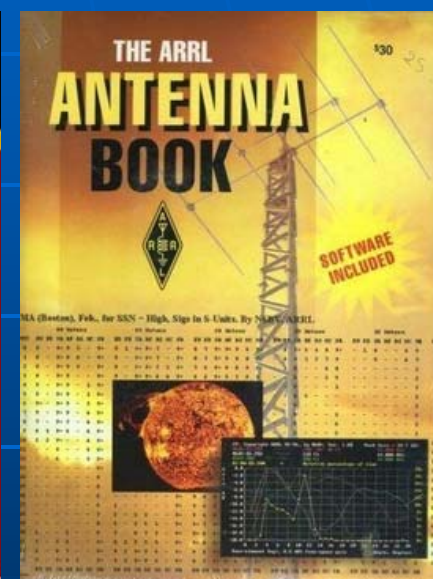
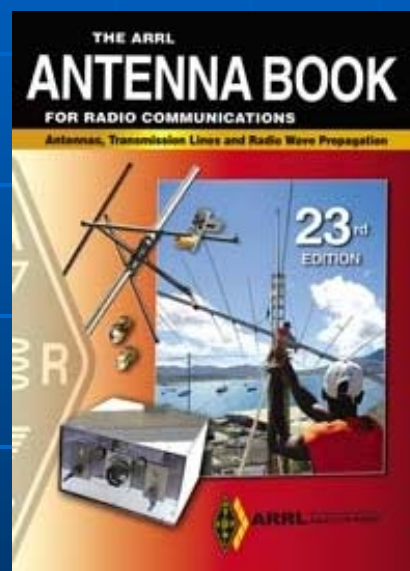
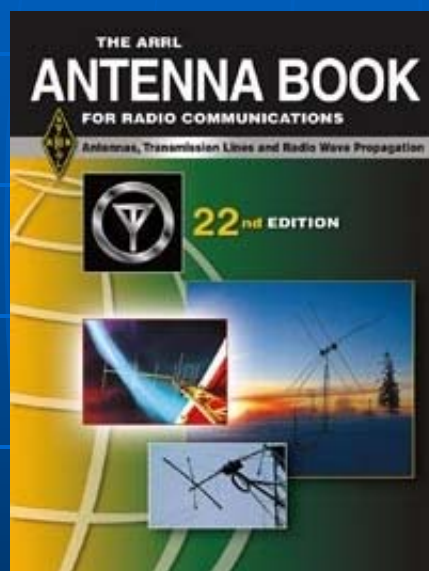
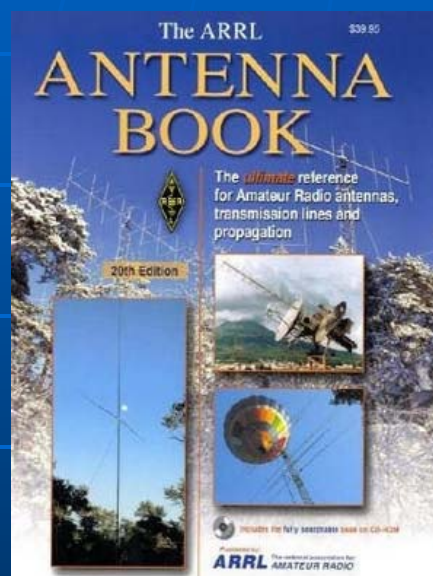
- Vertical antennas can be wires hung from trees, any conductor works, even free Harbor Freight tape measures have been used.
- Most vertical antennas need ground radials to work efficiently. Minimum is 4, not much improvement beyond 32.
- While most vertical antennas need ground radials, there are several that do not, including:
 - Gap-Titan
 - Cushcraft R7, R8, and R9 series

HF Antennas

- Depending on constraints, antennas may need to be installed in an attic or crawl space.
- Antennas can be disguised as a flag pole or downspout, or made with very thin wire that is virtually invisible, or temporary in nature (set it up, operate, take it down).
- Antennas can even be installed on vehicles and used with a base station.
- An antenna I have been experimenting with is the Magnetic Loop Antenna.

HF Antennas

- If funds permit, buy a reasonably current version of the ARRL Antenna Book.



- The Internet is full of antennas and plans, but not all perform as well as the author may claim.

HF Radios

- This will be your big expense.
- New vs. used decision.
 - New has warranty.
 - Used – let the buyer beware.
 - Watch out for online sales (Craigslist, E-bay), local hamfests may be a better place to look.
 - Depending upon ratings and life cycle, used gear may save you 50% over new.
- Ask Ham friends for advice and suggestions.
- Do your homework – don't just look at the score, read the E-ham reviews.


HF Radios

■ E-Ham Review pages:

Category (# of Products) ▲	Last Review ▼
Amateur Radio Equipment Repair (163)	17-Feb-2017
Amateur Radio Periodicals (49)	16-Jan-2017
Amplifiers: RF Power - HF & HF+6M (269)	17-Feb-2017
Amplifiers: RF Power - 6M/VHF/UHF+ (188)	16-Feb-2017
Antenna Analyzers (120)	17-Feb-2017
Antenna parts, accessories, incl. baluns, hardware, etc. (195)	14-Feb-2017
Antenna Rotators & Accessories (83)	06-Feb-2017
Antenna Switching, Phasing, Controllers (129)	17-Feb-2017
Antenna Tuners (334)	14-Feb-2017
Antennas: VHF/UHF+ Omnidirectional: verticals, mobile, etc (523)	17-Feb-2017
Antennas: HF Mobile & Accessories (280)	12-Feb-2017
Antennas: HF Portable (not mobile) (176)	17-Feb-2017
Antennas: HF: Vertical, Wire, Loop (710)	17-Feb-2017
Antennas: HF: Yagi, Quad, Rotary dipole, LPDA (476)	14-Feb-2017
Antennas: VHF/UHF+ Directional (Yagi, quad, etc.) (256)	10-Feb-2017
ATV equipment (15)	11-Mar-2012
Batteries & Chargers for amateur radios (80)	24-Jan-2017
Books/Manuals/Videos/Pod-WebCasts on ham radio (205)	16-Feb-2017
Contesting Hardware (32)	19-Jan-2017
DC Power Supply Distribution Panels (35)	18-Dec-2016
Digital Multi-mode decoders (27)	23-Jan-2017

HF Radios

■ A specific review:

Reviews Summary for Yaesu FT-920			
	Reviews: 173	Average rating: 4.7/5	MSRP: \$2299
	Description: Yaesu FT 920 HF/6M Transceiver		
	Product is not in production.		
More info: http://www.wm7d.net/hamradio/ft920/			

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N2MAQ	Rating: 4/5	Nov 9, 2016 16:09	Send this review to a friend
Nice rig but			Time owned: 0 to 3 months
<p>First let me say I really like this rig. A problem popped up last night. While talking on 10 meters to a local buddy I was trying a new mic. playing with speech proc. and power output settings when I noticed I could only turn power down and it was actually showing over 100 watts output no matter where the knob was set. This may or may not become a issue. Otherwise its a very nice rig.</p>			

KI4FQZ	Rating: 1/5	Sep 16, 2016 22:28	Send this review to a friend
Yaesu's Shameful Rig			Time owned: more than 12 months
<p>The FT 920 is an extremely ergonomic and physically attractive rig packed with excellent features. Also exceedingly simple to operate, and capable of excellent audio quality and most definitely a nice hot receive with very discerning audio with an undoubtedly smooth quality. Very pleasant to listen to. And with it's automatic antenna tuner which operates flawlessly, it creates a wonderful experience for the seasoned and new ham alike.</p> <p>Now the bad news. At the rather pricey purchase cost, and all it's technological features, I believe Yaesu should be ASHAMED to have built such a beautiful rig with the intention of making it completely disposable. The processor section of the rig is no longer available, and Yaesu no longer supports the rig at all. For a beautiful rig of this caliber, it is absolutely shameful that if one encounters a bad processor that they must just "throw it away" and purchase another Yaesu product that they hope will not follow suit. I have since purchased a Kenwood 950 SDX....who's is actually still supported.</p>			

Tips

- Watch out near band edges!
- Your buddy (an Extra) asks you (a General) to meet him at 7.175 MHz on for a sideband QSO. 7.175 MHz is the bottom edge of the General portion of 40 meters.
- If you key up, you are out of band!
- Your side band (lower side band on 40) extends down to about 7.172 MHz.
- The same applies near the top of bands when using USB.

Tips

- Keep a band chart posted by your radio.
- Know the band plans and be polite
- When getting ready to transmit, ask: "Is this band in use?"
- Use the minimum power needed to communicate clearly.
- Join a club. There is a lot of experience and wisdom there, and most are willing to share.
- Sometimes when a special tool is needed, someone in the Club will loan it to you or help you with the task.

Tips

- Offer to help other Hams. It's amazing how much you learn working with others.
- Look for and participate in HF nets.
- If you can afford it, join the ARRL.
- When someone is annoying you, remember, that's why you have a frequency dial. And in the worst case, and on & off switch.

A Quick Review of the Bands

So what affects HF Ham band propagation?

- Day or night or grey line.
- Time of year.
- Solar activity (and where we are in the 11 year cycle).
- Storms (creates electrical noise on lower bands).
- Antenna type (NVIS vs. others)
- See the handout for a brief description of band (and user) characteristics.