HF Antennas 101

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HF Antennas 101

- A good antenna may be the most important component of a good HF station
  - 1W QRP station + good antenna can be heard worldwide
  - 1KW station + bad antenna can warm the shack in winter
- Major antenna types
  - Vertical ¼ wave monopole
  - Horizontal ½ wave dipole
  - Beam/Gain (Yagis, quads, etc.)
  - Other (longwires, loops, etc.)
- You need something to get started – it need not be the best but once you get something up you’ll be able to experience HF communications, work DX, play in the contests – good antennas don’t have to be expensive – some of the best ones are just made of wire
SAFETY FIRST

- Unless you desire to become a crispy critter don’t do antenna-related activities anywhere near power lines EVER; during a thunderstorm; etc.
- Be careful; have at least one partner present during antenna activities; plan things out ahead of time and get knowledgeable help if you are out of your depth
- Quit if you get tired or if the weather turns against you or if darkness falls.
A Modest Station in Finland…

- Radio Arcala – OH8X
  - Finland
  - 7 huge towers
  - Professional engineering
  - 5 element 80M Yagi
  - 3 element 160M Yagi
  - www.radioarcala.com
OH2BH With the Rotor
But most hams aren’t THAT crazy

- You can do almost as well with a few $ of wire, practical know-how and a little bit of antenna theory
  - Group called “Zuni Loopers” used to put up wire “gain” antennas for Field Day and were competitive with < 5W
  - Many home stations get on the air with single or multi-band wire dipole
  - Gain antennas important when contesting or DX’ing, but not needed for casual contacts or getting started
What makes a good HF antenna?

- Whatever fits the desired situation
  - Cost - what is the budget?
    - Short term installation – wire antennas go up quickly, may come down easily
    - Long term installation – towers require engineering, permits and $$$
  - Location - where does it need to go?
    - Terrain, lot size, available supports, feedline routing?
  - Bands – what is the available space?
    - Low bands (160M, 80M) usually require more room
  - Coverage – where does the signal need to go?
    - Antennas can be omni-directional, partially directional or strongly directional
  - Esthetics – spouse appeal, CC&R’s, neighbors
    - Verticals and wire antennas are usually less visible than towers
    - Shortened antennas are also less visible, but even less efficient
How to get started?

1. Easy to get started
   - Higher HF band coverage (40M through 6M)
   - ½ Wave wire antennas
   - Multiband wire antennas

2. Compromise
   - Multi-band verticals incorporating a counterpoise
     - Lower signal level, higher noise

3. Bigger Projects
   - Low band coverage (160M & 80M)
   - Towers & Yagis
   - Verticals that require external groundplanes/counterpoises
   - Complex oddballs (quads, rhomboids, etc)
½ Wave (Dipole) Wire Antennas

- Easy to Build
- Two pieces of wire, 1:1 Current Balun, coax from balun to transceiver, support for wire (ends) or balun (center)
- Basic formula for overall length of wire (both pieces) is \( L = \frac{468}{f(MHz)} \) (so at 14.2 MHz the antenna wire is 32.96 feet long or 16.48 feet long on each side. Always cut the wire a bit long so that you can trim it down to the exact match you want as environmental conditions often affect antenna resonance frequency.
- Current Balun keeps RF off the shield of the coax – this is a good thing.
The Coax-Fed Inverted-V Dipole Antenna

Fig 8—The inverted-V dipole. The length and apex angle should be adjusted as described in the text.
Multi-band Wire Antennas

- Similar to $\frac{1}{2}$ wave wire antennas
  - include “Traps” on each side to allow resonance on more than one frequency.
- more expensive
- can be problematic if the traps fail (and they do)
Multi-band Verticals w/ Counterpoise

- A number of approaches
- Steppir Vertical: Adjustable-length vertical radiator is set to correct length
- Trap Vertical
- Inverted-L (part vertical, part horizontal)
- All Usually require a counterpoise
  - Elevated Radials (typically 4 at resonance)
  - Buried Radials (can require about 100 @ 50+)
- Some require a tuner of some sort at the feedpoint
Steppir Vertical Base Unit
Steppir Vertical (BiggIR Model)
Cushcraft R7000 Vertical – No Radials – lots of traps and linear loading
Low Profile Yagis – Steppir 2 Element

- Steppir has a very low profile 2 Element Yagi
- Excellent Performance
- A bit on the expensive side
- Low Wind Profile
- Easily installed on a roof-mounted tower
- Somewhat stealthy
Steppir 2-Element
Steppir Step Module
Steppir Step Module - Conductor
W6DR’s Roof Tower Installation: 2 Ele Steppir for HF and 5 Ele KLM for 6M
W6DR - Full Size 160m Dipole – Balanced Feed – Tree Supported
Best Way to Feed Balanced Antennas at 1.5KW: PALSTAR BT1500A
Palstar BT1500A Insides
Inverted-L

- Somewhat stealthy
- Can be fed with an automatic tuner for increased bandwidth – otherwise bandwidth will be somewhat narrow
- Requires counterpoise
- Can be hung between a couple of tall trees
- (-) Noisier than a horizontal antenna
- (+) Lower take-off angle than a horizontal antenna
Inverted-L – Good Choice for 40-160M

Fig 58—Sketch showing a modified 160-meter inverted L, with a single supporting 60-foot high tower and a 79-foot long slanted top-loading wire. The feed-point impedance is about 12 Ω in this system, requiring a quarter-wave matching transformer made of paralleled 50-Ω coaxes.
Inverted-L on 160M

Fig 57—The 1.8-MHz inverted L. Overall wire length is 165 to 175 feet. The variable capacitor has a capacitance range from 100 to 800 pF, at 3 kV or more. Adjust antenna length and variable capacitor for lowest SWR.
Stealth Antennas: End Fed Wire

Fig 28—The “invisible” end-fed antenna.
Stealth Antennas: Inverted L Gutter
Automatic Tuner-Based Antennas

- Tuner costs a bit
- Will work with almost any conductor (longer usually better)
- Will work in a vertical/counterpoise configuration
- Will work in a balanced antenna configuration
- Limited Power (60W/100W/200W/500W units available)
- Excellent Stealth characteristics
Automatic Tuners – SGC-230
Stealth Antennas: SGC-230 Feeding a Vertical Aluminum Pole
Stealth Antennas: Other Ideas

- Attic Dipole (be careful not to start a fire)
  - Can broaden the bandwidth by using multiple conductors to form a “fat” element
- Gutters
- Wires in trees
- Wires in fences
- Loop antennas on roof