

# Antennas

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So, you want an  
HF Antenna.....

Which One ?

# The first thing to remember is:

- Every antenna is a compromise !
- You can have an antenna with:
- Wide Bandwidth
- High efficiency
- Small, compact size
- Pick any TWO of the THREE !

# Examples

- Log Periodic: Unidirectional, covers several Bands, A Large antenna.

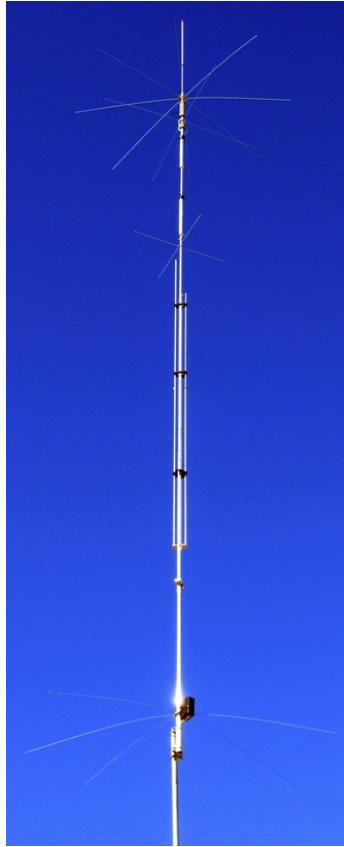


- Dipole: Bidirectional, single Band, has to be high (over  $\frac{1}{2}$  wavelength) above ground to be efficient.





- Ground mounted Vertical: Omnidirectional, efficient with large ground radial field.



- Elevated Vertical: omnidirectional, narrow Bandwidth, optimum mounting height 18', efficient with 3 to 4 tuned elevated radials.

A commercial Multiband with a ground plane is shown





- Mobile: Shortened Vertical, compact, very narrow Band(high Q), suffers efficiency, 200 to 300 watts max.



- Small Transmitting Loop (STL): compact, very narrow Band (high Q), ground independent at height of only  $\frac{1}{2}$  loop diameter, QRP power limited unless expensive tuning capacitor is used. Excellent portable antenna. Think of it as a Mobile Antenna that does not need a vehicle attached.



## PRACTICAL

- Two very practical multiband antennas that are relatively inexpensive, effective, and easy to install are the Multiband End Fed Half wave Dipole, and the ground mounted vertical with a remote Antenna Tuner.

End fed half wave: Multiband Antenna,  
130 ft: 80 thru 10 meters without an  
Antenna Tuner.

61 ft: 40, 20, 15, 10 meters

Same performance as Dipole but prone  
to RFI, needs 1 or more CFC (current)  
Choke(s),

Can be hung as a horizontal dipole,  
Sloper, inverted V, inverted L,  
or as a half wave vertical

Recently very popular



# Vertical Antenna with remote ATU

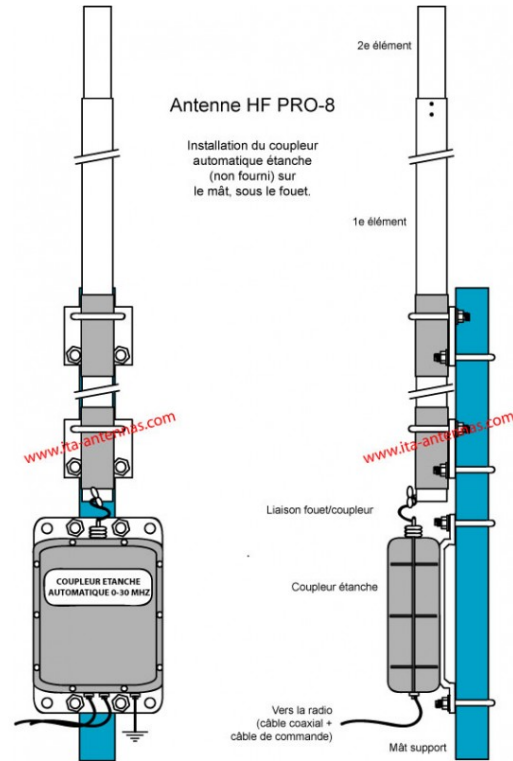
The Vertical antenna can be:

- an aluminum mast antenna
- A telescoping fiberglass pole with a 16 or 18 gauge wire run up inside the pole
- Even just a wire hung from a tree limb
- Length can be anything over 23 feet

The length is chosen to be close to, but not resonant

- A Remote ATU, like the Icom-AH4, is installed at the base of the vertical.

# Vertical with Remote Tuner



- The Remote Antenna Tuner will match the input impedance of the antenna on all bands and minimize power losses in the coax between the radio and the antenna.
- As with any Vertical antenna (except the half wave vertical), a ground connection and radials must be used.



# Ground Radials

- Vertical antennas (except Half Wave Verticals) require a ground radial system,
- HOW MANY RADIALS DO I REALLY NEED?

An 8 ft ground rod sunk at the base of the antenna is the Bare Minimum required ground system. Adding to this

- 4 radials will increase EIRP by +1.1dB
- 8 radials will increase EIRP by +1.6dB
- 16 radials, EIRP increases by +2.2dB
- 32 radials, EIRP is increased by +2.4dB
- 64 radials, EIRP is increased by +2.55db

At least 16 radials are recommended.

( EIRP: Effective Isotropic Radiation Power )

# Effect of ground radials

- $\frac{1}{4}$  wave ground mounted antenna with an 8 ft ground rod can have a ground resistance of 28 to 58 Ohms(average is 44 Ohms).
- Ref: QST May 1951, & Rudy Severns N6LF QEX May/June 2009
- That means your antenna would have a radiation efficiency of between 38% and 56% so I'll use the average of 45%. Yeah, your 100 Watts is only going to radiate 45 Watts, the other 55 watts is going to heat up the ground! Let's see what ground radials do for us.....

# Radials versus just the ground Rod

- | # of radials | Improvement<br>DB | percent | with 100W input,<br>Power Radiated |                |
|--------------|-------------------|---------|------------------------------------|----------------|
| 0            | 0                 | 0       | 45                                 | W              |
| 4            | + 1.1             | 129 %   | 57.97                              | W              |
| 8            | + 1.6             | 144.5%  | 65                                 | W              |
| *16          | + 2.2             | 166 %   | 74.7                               | W *recommended |
| 32           | +2.4              | 174 %   | 78.2                               | W              |
| 64           | +2.55             | 180 %   | 81                                 | W              |
- Note that adding those last 32 radials only increased radiated power by less than 3 watts ! .....diminishing returns!


My friend in Virginia owns a nice home, a large back yard and unfortunately, an H.O.A..

- We installed a tilt-over 43 foot Vertical with a remote ATU.
- The shiny aluminum antenna is painted flat brown.
- The HOA has allowed the antenna, with the stipulation that it is raised only when actually being use.









I have been studying and experimenting with Small Transmitting Loop ( STL ) antennas and will share my findings soon.

But that is another story,  
Thanks for your attention.

~ W4RQ ~

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