# BUILD A SHORTWAVE ANTENNA

**"The Search For The Perfect Shortwave Antenna"**
**by N4UJW Webmaster Hamuniverse.com**

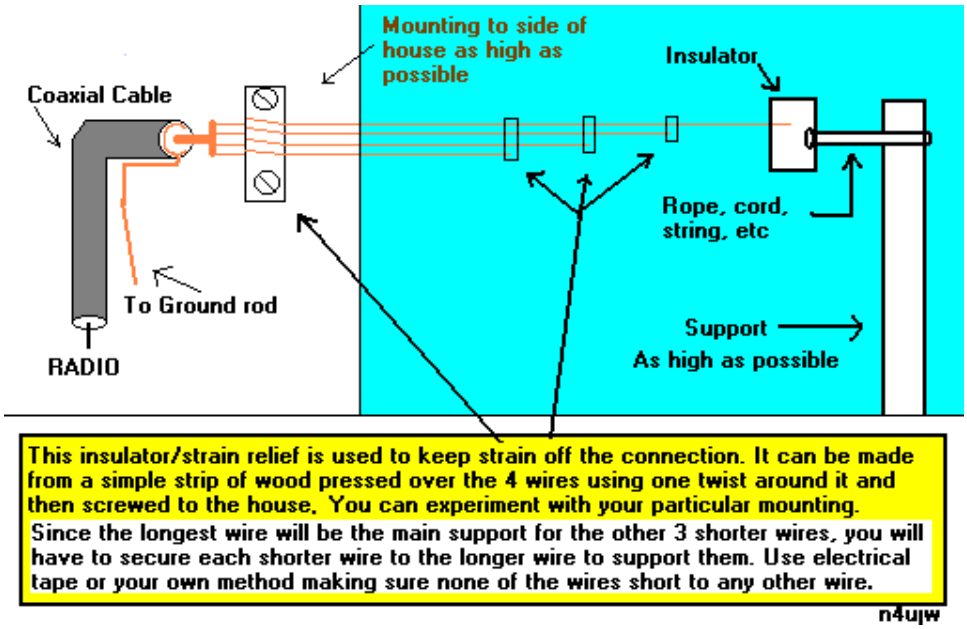
## THE MULTIBAND LONG WIRE SHORTWAVE ANTENNA

A Much Better But More Complicated Antenna

This antenna is end supported and designed to receive the major shortwave bands between 90 meters and 16 meters. It uses only 4 wires and a unique antenna property called harmonics to get 8 bands using only 4 wires! Again, it is a compromise but an excellent performer....the perfect antenna does not exist. We "Hams" are working on it constantly!

After construction, this shortwave antenna should be stretched out in a straight line as high as possible as in the long wire antenna above, and about 140 feet straight out from the house! Don't fret! If you cant', you can't. Utilize your existing space. More supports may be required for a zig zag layout but performance may suffer a bit. Don't worry, it will certainly outperform that built in poor excuse for an antenna!

It consists of 4 separated insulated wires, (measurements below), all connected (soldered) on one end, leaving the opposite end unconnected and insulated at the support. If you do not know how to solder, then scrap all the coating from the wire down to bare copper and tie the ends together using several knots. You really should learn to solder though!. This will make for a more permanent and much better electrical connection.
The soldered end must be between an insulator and the radio for mechanical strength.
You don't want much stress on the soldered connection other than the coax leading to the radio. The end that has all wires connected should be soldered to the center wire of a suitable length of 50 - 75 ohm coaxial cable leading to the short wave radio with a suitable connection. A ground wire is soldered to the shield only of the coax at the same end that you soldered all the wires together and attached to a ground rod driven into the ground near the house. Seal and tape all outdoor connections from the weather. This antenna is called an end fed half wave antenna.
See picture, formula and wire measurements for bands below:
(The lengths are not extremely critical, but try to get them as close as possible.)




Note: In the instruction box above, the last sentence refers to the long portion of the wires, not at the connection point to the coax feed line to the receiver. All wires are connected together at the connector center conductor wire!

(frequencies shown below are approximate shortwave band centers):

Wire 1 (LONGEST WIRE) 3.25 MHz (90 meter band) 09.75 MHz (31 meter band 3rd harmonic)
468 ÷ 3.25 = 144' 0"

Wire 2 3.95 MHz (75 meter band) 11.85 MHz (25 meter band 3rd harmonic)
468 ÷ 3.95 = 118' 6"

Wire 3 5.10 MHz (60 meter band) 15.30 MHz (19 meter band 3rd harmonic)
468 ÷ 5.10 = 91' 9"

Wire 4 (SHORTEST WIRE) 5.90 MHz (49 meter band) 17.70 MHz (16 meter band 3rd harmonic)
468 ÷ 5.90 = 79' 3"
The number 468 divided by the frequency above is the formula for calculating a half wave antenna length used all the time by Amateur radio operators in building many different kinds of antennas.
You'll need about 435 feet of wire for this antenna plus appropriate length of coaxial cable.

The wires are spread 3-4 inches apart, held in place with simple non-conductive spacers.
Just cut a few pairs of the acrylic, Plexiglas, plastic strips or other non-conductive material that will not be damaged by moisture long enough to attach the wires keeping the spacing about 3 to 4 inches or further if you want.

## OUTDOOR CENTER FED MULTIBAND (FAN) DIPOLE SHORT WAVE ANTENNA

NOTE: For use with the higher quality table model communications receivers that have standard antenna connectors capable of using direct coaxial cable connectors.

This antenna type is used by many Ham Radio Operators worldwide and is very popular but the lengths for the Ham bands are entirely different.
The entire length of the antenna is about the same as the one above and the coaxial cable is connected in the center of the span with the center conductor connected to one side of the antenna and the shield connected to the other side then at the other end, to the receiver.
The formula used for this antenna is the same as the Multiband Long Wire above:

468 / by frequency in mhz = total length in feet. This resulting length is cut in half!

One antenna per band stacked.

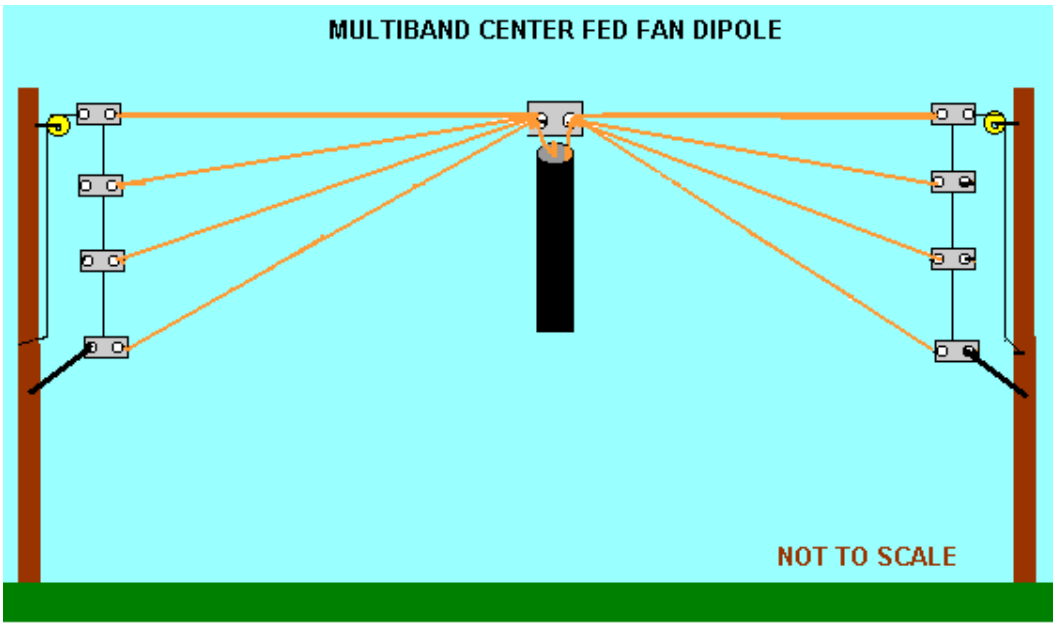
It is somewhat more complicated in construction due to the center connection and requires support in three places....each end plus the center. The preferred method for using this antenna is drawn in the picture below with the wires "fanned" apart with at least a foot of separation between the ends.
All of the wire elements can be close spaced but some interaction will occur. Insulated wire is best so the individual wires do not connect on the longer lengths of the antenna.

Choose the antenna of your choice depending on your constructions skill and needs.
Either way, they both will be much better than the little telescoping antenna that comes with most portable receivers.

The center fed multiband dipole antenna (drawn below) consists of 2 separate sections of 4 wires on each side of the center connection at

the support consisting of 4 wires connected to the center conductor of the coax and the other 4 connected to the shield.

In this arrangement, one half of the antenna is feeding the center conductor and the other half is feeding the shield. Each side must be insulated....not connected....to the other side. The other end of the coax is connected to the radio with the appropriate connector.
Use lengths in the above multiband antenna with total length split in half using the formula....half on one side and half on the other for each wire length per band. The coax can be anything from 50 ohm to 75 ohm.
Not critical on receive!




**Shown supported between two wooden poles. Gray rectangles are insulators.**
**Yellow circles are pulleys.**
**Orange lines are dipole elements.**
**Heavy black vertical line in center is coax leading to radio.**
**Note that one side of antenna is connected to center of coax, shield to the other side.**

The final assembled antenna can be installed with the center section higher than the ends, making it look like an inverted V, like this /\ .
Make the angle of the V about 90 degrees or more.
Or it can be horizontal to the earth or anywhere in between.
The inverted V configuration is more omni-directional, (all directions), than the horizontal method which tends to receive best, broadside to the wire. Less real estate is required for the inverted V method. Center supporting also has less tension on the antenna so smaller wire size may be used to save money.

Choose the antenna of your choice above depending on your constructions skill and needs. Either way, they both will be better than the little telescoping antenna that comes with most portable receivers. Enjoy!

## INDOOR MULTBAND SHORTWAVE ANTENNAS

### Attic Antennas

To begin with building and installing an attic antenna that helps your reception, you need to take stock of your attic's measurements, particularly the length of the attic at it's longest distance that you have easy access and your radio's location.
One of the more common house sizes is about 50 to 60 feet long and about 25 to 30 feet wide at the ground level. Your house or home may be entirely different. The accessible attic space usually is much less than this. You will have to really compromise with an attic antenna as far as the band coverage is concerned for a short wave antenna to perform adequately. Use the dimensions of your attic and compare them with the lengths of the long wire and dipole type antennas in this article above and choose the one that you can "fit" into the attic. You may not be able to use lengths for all the bands, but again, no matter what length your end result is, it will certainly outperform that little pip squeak of a poor excuse for an antenna that came with the radio! Just utilize the space that you have and don't worry about the length. Just use as much wire as you can and forget about that "perfect antenna". It still does not exist up to this point in this article! Hams are still working worldwide on it!

The best place to mount or attach the antenna is against the peak or highest part of the roof thereby keeping it away from ductwork, AC and heater systems, telephone and all the other metallic environment that exists in most attics. Once you have the location selected, then build the antenna while keeping in mind that the coax or wire will have to get to the radio. If you're working up on the roof, get a helper to assist, an adult, not children! Be careful on those ladders!
You can push most small coaxial cable under the space where the carpet and wall come together and wire should be no problem, then to the nearest closet, up the wall and into the attic. You can work from the attic down or radio up....your choice. Lots of variables here too so you will have to choose your own route and method of installation. If you have to drill into a wall to feed the wire, use caution and don't drill into electrical wires! It may be the last time you do!

## IN ROOM ANTENNAS!

In those cases where you can't put an antenna outside or up in the attic, then you can install it in the same room with the radio! They won't be as effective as those up in the attic or outside but will still get more signal to your radio which is what you want.
Simply use your own method to attach a random length wire, up next to the ceiling against the walls...around all sides of the room if possible. One other choice is to push a random wire between the carpet and the baseboard around the walls of the room. You will be surprised at the difference compared to that telescoping antenna that came with your radio. Just attach the antenna to the telescoping rod...don't forget to remove the insulation on the wire at the attachment point!

Check out the Ham Radio Antenna Projects here!