QFH Antenna Construction

Goal

The following antenna construction guide is based on Jekhokie guide on this website. All credit goes to them for the design. We wanted to put together clear step-by-step instructions for the construction and use with the standard RTL-SDR. Many of these parts can be easily swapped out with similar ones / adapted for your setup but we listed readily available parts that should let you put it together for relatively cheap. We opted to not 3D print components to further push the possibilities in cost savings of a DIY QFH antenna.

BOM

All major components are listed below. Small components/tools are assumed to be had.

Quantity	Price Per	Name	Vendor
2x	$26.99	5/16in x 10ft Copper Tube	Amazon
1x	$14.99	32.8ft BNC Male to BNC Female RG58 Coax Cable	Amazon
1x	$5.80	MCX Male to BNC Female RG316 Low Loss Pigtail Adapter	Amazon
8x	$1.03	90 Degrees Elbow Copper Pipe Fitting Brazing Connection 5/16in	Amazon
1x	$7.87	1.5in x 5ft PVC waste pipe	Lowes

Copper Tube

- This material and diameter were chosen for this antenna build because of its high electrical conductivity and resistance to corrosion. The material is also very malleable which is needed for the curved/bending of the antennae poles.

RG58 Coax Cable

- This cable was chosen because we need a lengthy connection and a durable cable to connect to the MCX RG316 RTL-SDR that will be connected to a Rasberry Pi 4 Model be.
- Coaxial cable Male end is not necessary to the build and will be cut to expose the copper wiring needed to make the connection to the antenna
- There will also need to be a balun created from the coax cable.

MCX RG316 Adaptor

- This is necessary to attach the cable to the NOOELEC SDR, a different one may be chosen depending on the SDR you are using.

PVC Waste Pipe

- This is a relatively inexpensive and accessible material that will be used as the main shaft of the antenna.

Assembly

The dimensions of the QFH antenna will be to the measurements of Figure 1 below. All measurements are in millimeters (mm) and can be adjusted based on your build and needs, but be sure to use precise measurements as the QFH antenna needs to be constructed accurately to maximize the efficiency, gain, and radiation pattern. If different dimensions are wanted the use the following calculator to adjust for your build: QFH Calculator.

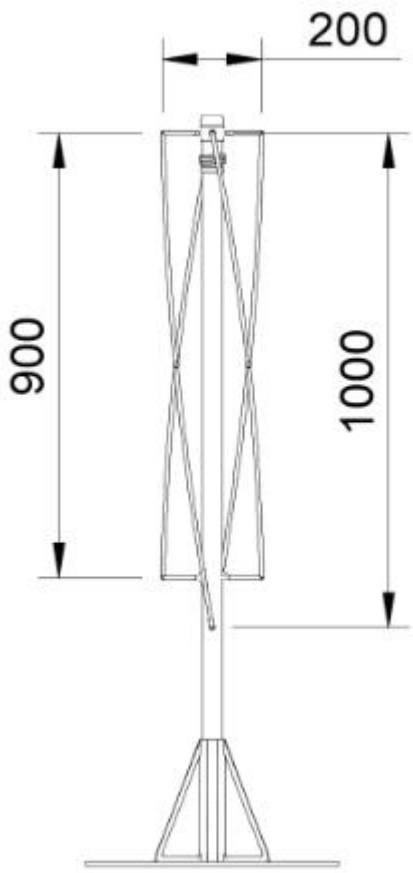


Figure 1: QFH Antenna Dimensions

Starting with the PVC Waste Pipe measure from one end of the pipe, and mark 25mm, 925mm, and 1025mm. These will be the points that you will use to insert the copper conductors.

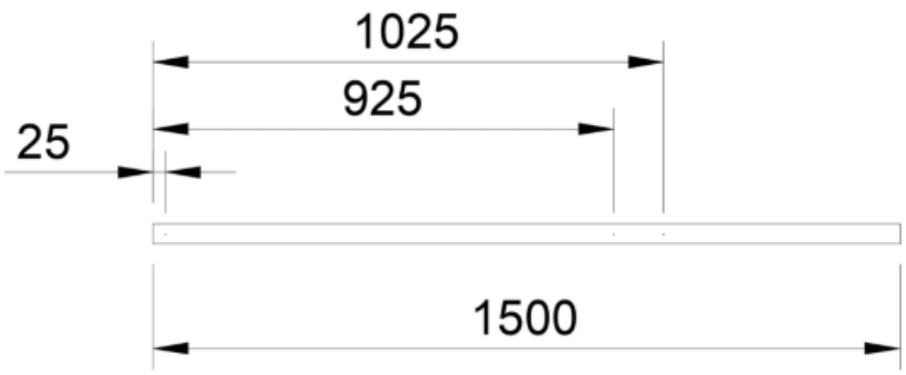


Figure 2: PVC Shaft Connector Location Markings

Next cutting the 5/16'' (8mm) copper tubing into four different lengths:

- Four 85mm length for the top horizontal conductors
- Two 185mm length for the bottom horizontal conductors
- Two 898mm length for the short vertical helix conductors
- Two 995mm length for the long vertical helix conductors

Figure 3: Copper Tube Cut Segments (Photo Cred: Jekhokie)

Note: To get the copper tube as straight as you can, try placing the tube between two pieces of wood and rolling until straight.

Take the 85mm length conductor pieces and drill a 1/16'' hole approximately 5mm from one end of each length. These holes will be used to connect the wiring and inserting self-tapping screws.

Next, with the marked PVC pipe drill four 5/16'' (8mm) holes 90 degrees apart from each other at the 25mm marked location. Drill the same size hole with the bottom two points (925mm and 1025mm), instead of 90 degrees we will do 180 degrees for both holes, but 1025mm holes should be 90 degrees from 925mm holes.

[Insert Photo]

Next, drill one 7mm hole approximately 100mm from the 25mm hole were the four conductors are located. This will be where we will insert the RG58 coax cable. Cut off the male connector and fish in this end into the drilled hole.

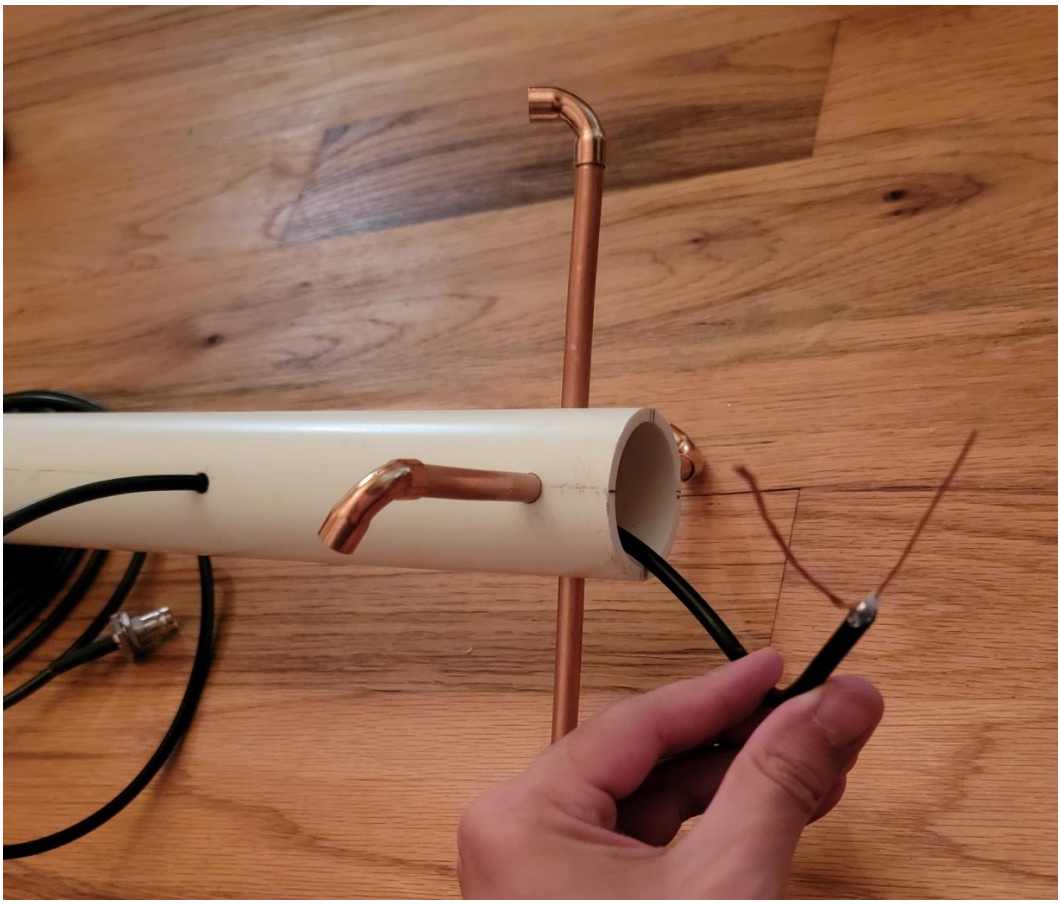


Figure 4: RG58 Coax Cable

When you cut back the protective sleeve be sure to be careful and not cut the braided wire too much. Carefully peel back the braided wire and twist them into one. Then peel back the foil to expose the singular solid copper wire (this might be coated in a plastic sleeve that will need to be cut).

Next, pass the central solid copper wire through the drilled hole at the end of one of the long helix element loops, then all the way through the end of one of the short helix element loops. Pass the outer woven metal braided wire through the remaining holes on the other short helix element loop and long helix element loop. Hold the wires in place with the four self-tapping screws

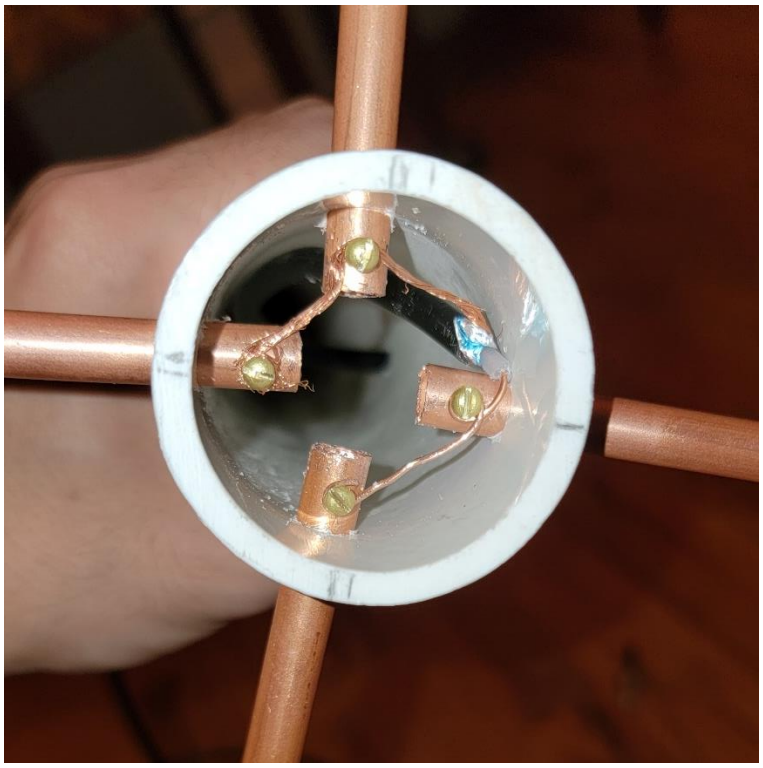
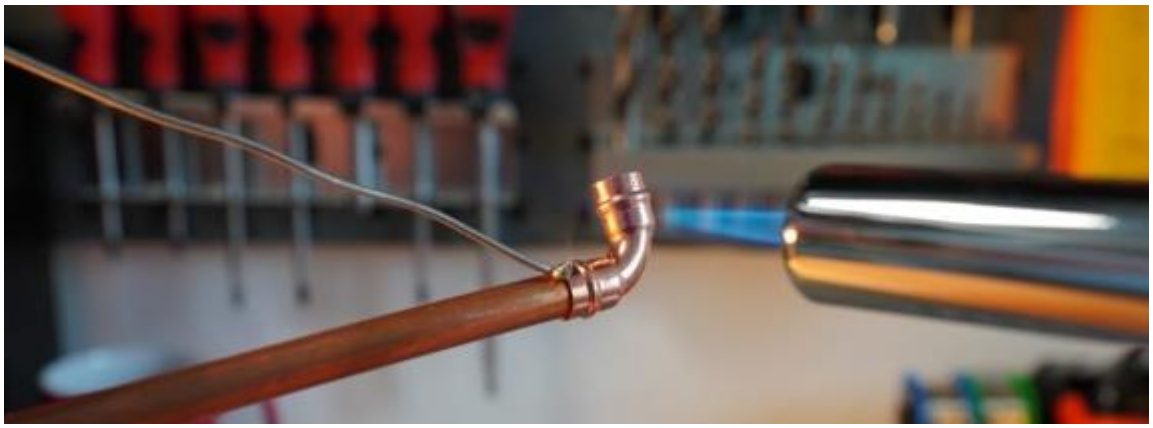


Figure 5: Wire placement

Finally, we will create a balun with the coax cable. Wind the coax cable around the shaft four times. Here we used plastic glue and a zip-tie to hold the cable in place.

This plays a crucial role in maintaining signal quality, reducing interference, and optimizing the performance of any antenna.

Now, connect your copper elbow connectors to your conductor segments with solder and a blow torch. You will probably need 16 connections.



Finally, connect all of your copper conductors with the short conductors connected to the 925mm location and the longer conductors connected to the 1025mm location. Insuring that the connectors connected to the 90 degree connection below.

Result