

# SatNOGS

## Helical Antenna v4

Make your own SatNOGS v4 Helical UHF Antenna

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# INTRODUCTION

This is a guide to build Helical UHF Antenna v4. The central frequency is 434Mhz and the antenna is can be Left-Hand or Right-Hand Polarized.

**During all steps make sure to check with the Dimensions Table file**

<https://github.com/satnogs/satnogs-anten...>

## Needed Files

All needed files are available in the SatNOGS Helical Antenna Repository:

<https://github.com/satnogs/satnogs-anten...>

summary files for RHCP antenna in stl and dxf format

Helical-434-8-RHCP.stl

Helical-434-8-RHCP.dxf

summary files for LHCP antenna in stl and dxf format

Helical-434-8-LHCP.stl

Helical-434-8-LHCP.dxf

printable blueprint file for RHCP in dxf and pdf format

Helical-434-RHCP-printBase.dxf

Helical-434-RHCP-printBase.pdf

printable blueprint file for LHCP in dxf and pdf format

Helical-434-LHCP-printBase.dxf

Helical-434-LHCP-printBase.pdf

6 radial base file for plexiglass or polycarbonate base

Helical-434-6radialBase.dxf

Helical-434-6radialBase.pdf

plexiglass or polycarbonate triangular connector files

Helical-434-Triangle.dxf

Helical-434-Triangle.pdf

cooper matching triagle

Helical-434-CooperTriangle.dxf

Helical-434-CooperTriangle.pdf

dimensions table

Helical-434-8.xls

Characteristics calculation site.

<http://www.vk2zay.net/calculators/helica...>

All calculations are on axial mode

Any change of the pipes diameter must take into consideration the fact that they are attached on constant diameter of 220mm

Precise dimensions are provided on the files linked

For RHCP and LHCP antennas

Letters A,B and C are marking the 3 PVC pipes

The RHCP design uses a B-A-C arrangement and the LHCP a C-A-B arrangement

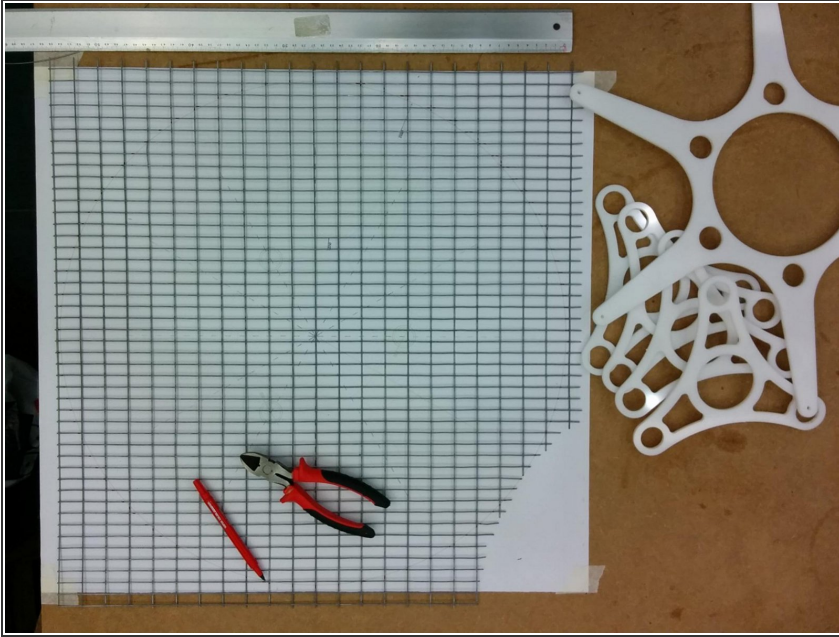


## PARTS:

- 25mm wide 1430 long PVC (16 atm) pipes (3)
- plexiglass sheet 400x400x5mm (1)
- plexiglass sheets 250x250x5mm (4)
- 6m brass wire 3 mm (1)
- package of tire ups (1)
- copper sheet 100x180x0.5mm (1)
- PVC plexiglass glue (1)
- Type-N connector (1)
- Cost and alternative materials (1)

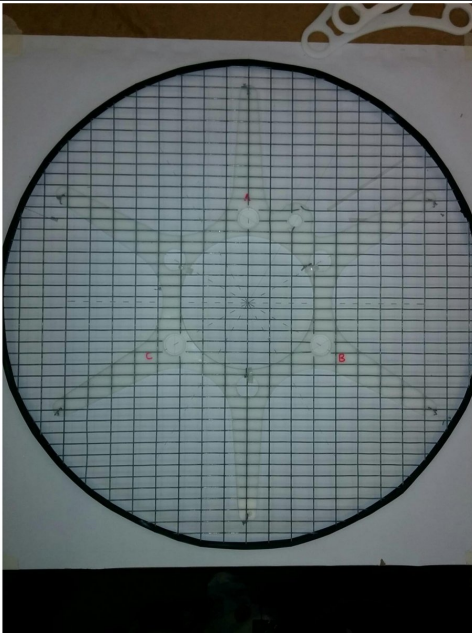
*In EU cost is calculated around 60 euros Instead of plexiglass polycarbonate sheet can be used Instead of PVC pipes Polypropylene pipes can be used Brass is used since it's more rigid than copper and able to maintain it's form. Using copper can also be used alternately.*

## Step 1 — Positioning the reflector grid



- Position and secure the printout of the base on your workbench
- Position the reflector grid axially, and mark a perimeter of 552mm to cut.
- Cut the the perimeter and adjust adhesive tape around it to avoid cutting ourselves.
- *Optionally after finishing up and positioning our antenna on a rotator tape can be removed.*

## Step 2 — Stabilizing the 6-radial base



- Position the plexiglass 6 radial base on the corresponding mark on the printout. In the case of a LHCP antenna, follow the picture provided, for a RHCP antenna it should be vice-versa.
- Stabilize the plexiglass on the printout using adhesive tape. Position the reflector on the plexiglass and use tie-ups and small wires to tie-up the six small peripheral holes and the 3 inner holes that will not be used to place PVC pipes through them.
- Cut the grid on the positions the pipes and the N-type connector will be placed.



### Step 3 — Marking the pipes



- Cut 3 PVC pipes 1430mm long
- Connect them in parallel and mark a straight line through all three of them
- This line will be used for the horizontal positioning of the contacts with the helical and the triangular plexiglass supports.
- Mark the bottom of your pipes as A,B and C

## Step 4 — Prepping the pipes



- Mark the positions of the helical and the plexiglass supports on each pipe using the provided dimensions table starting by -40mm
- Create a small cavity, in angle using a small file, on the contact spots of the PVC pipes and the helical (**Attention! Don't create a hole**, the angle must be around 15 degrees and it's direction is dependent by the helical orientation. eg in the photo provides is for an LHCP antenna).

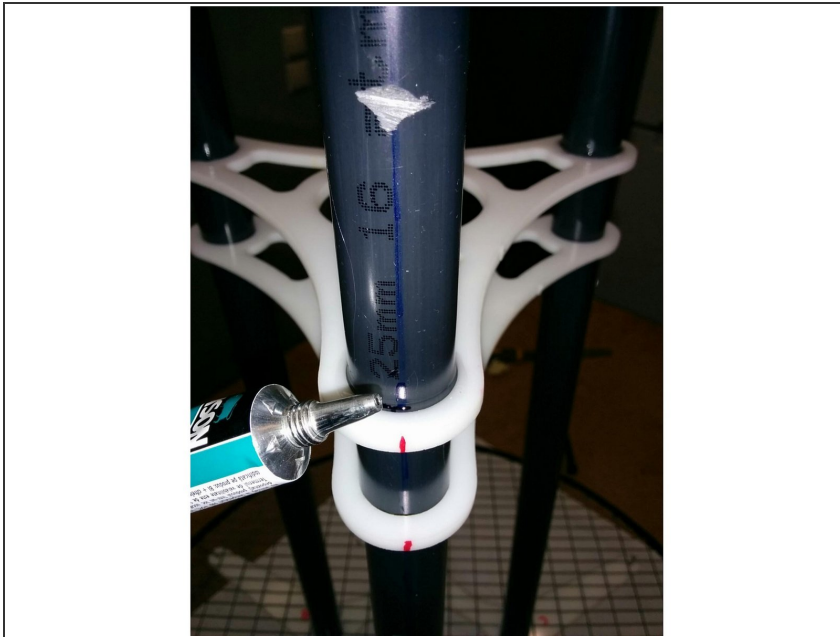


## Step 5 — Positioning triangular stabilizers



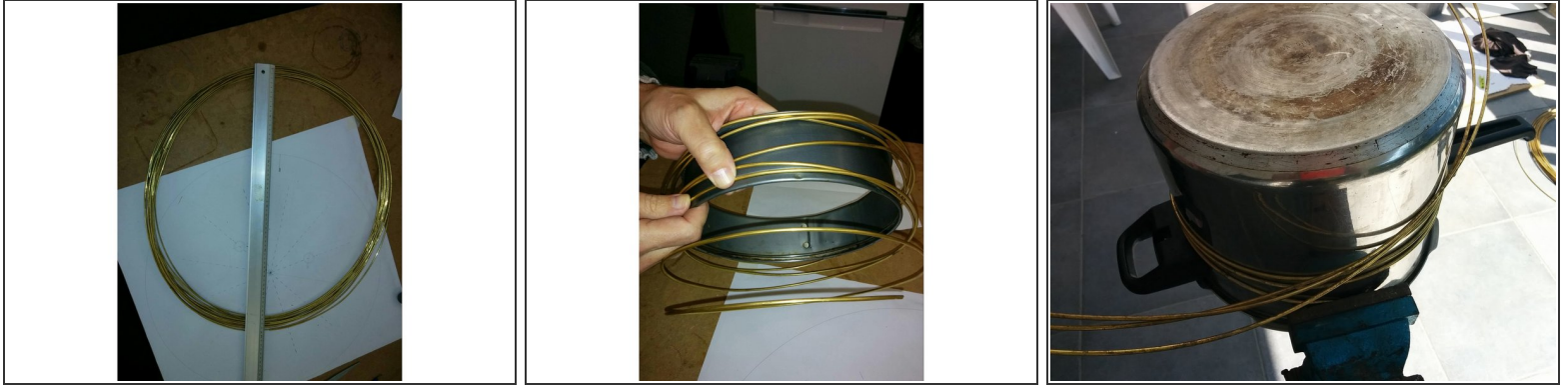
- Using the printout mark the triangular plexiglass on the alignment of the tube center as depicted
- Position the tubes on the plexiglass base and adjust the triangular stabilizers on their corresponding positions
- Turn the pipes to align to the marks on the triangular stabilizers

## Step 6



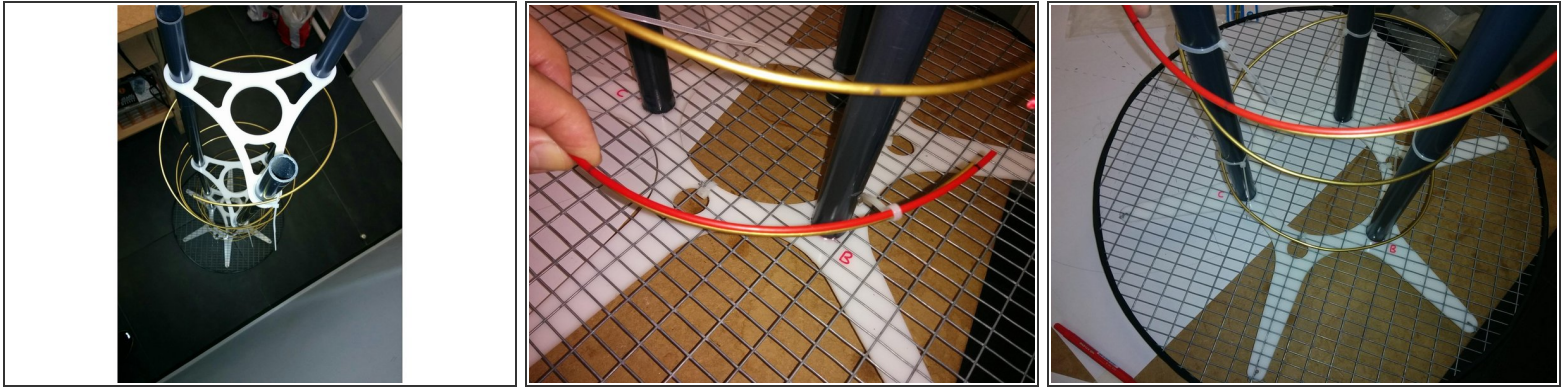
- Apply PVC-plexiglass glue and stabilize the second triangular stabilizer first.
- **Don't apply glue to the first stabilizer because it will be fixed on the final antenna application on the ground station.**
- Glue the basis and the third triangular stabilizer. Apply glue to both sides and let it be rigid.

## Step 7



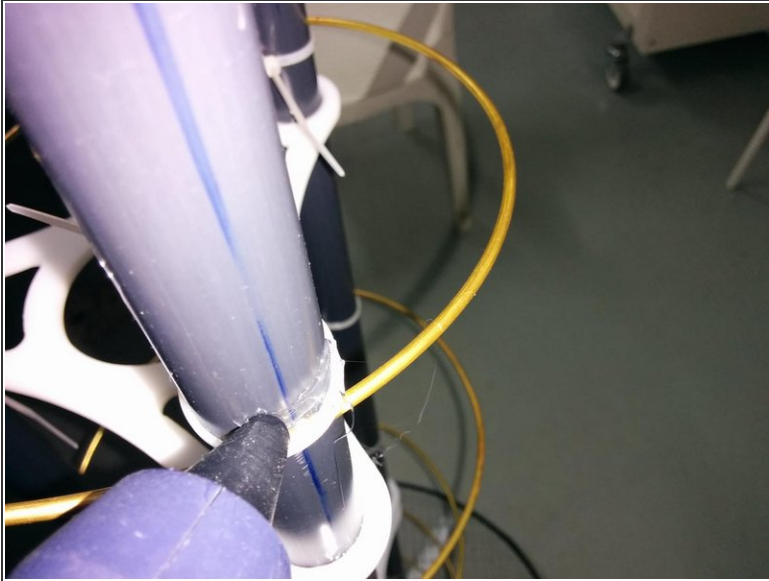
- In our example we will use brass wire, 1.5mm wide from a 60cm diameter packaging. We cut more than 6m. (our final length shall be 5696mm).
- Due to the fact that one turn equals  $5696/8=712\text{mm}$  the diameter must be  $712/\pi=226\text{mm}$  aprox. Turning must be clockwise or counter-clockwise depending whether it's a RHCP or a LHCP antenna.
- Using any cylindrical object (in our case kitchen ware) we turn the wire in 23-24cm perimeter.

## Step 8 — Positioning the helical to the PVC pipes



- Position the helicoid around the three PVC pipes clockwise or counterclockwise depending on the antenna you want to build, (RHCP or LHCP). On the picture provided it's an LHCP antenna.
- At the basis of the helicoid we mark on the helicoid the PVC-helicoid contact positions according to the provided dimension table.
- First mark from the base is at 178mm, from N-type connector to position B, next 23 marks every 237,3mm and you will get a 59mm free hanging cable in the end. To do so we used plastic ABS filament marked every  $712/3=237,3\text{mm}$
- As soon as the positions of the helicoid are marked on the PVC pipes tire-ups should be used to initially position the helicoid to the PVC pipes, except at position B, during that it's advised to constantly check the geometry and the proper positioning of the antenna.

## Step 9 — Attaching the helical to the pipes



- Using hot glue, attach the helicoid to the PVC pipes on the cavities we created using the file in a previous step . Leave it to dry up and get rigid.
- Using tire-ups over and under the cavities would provide even greater rigidness.



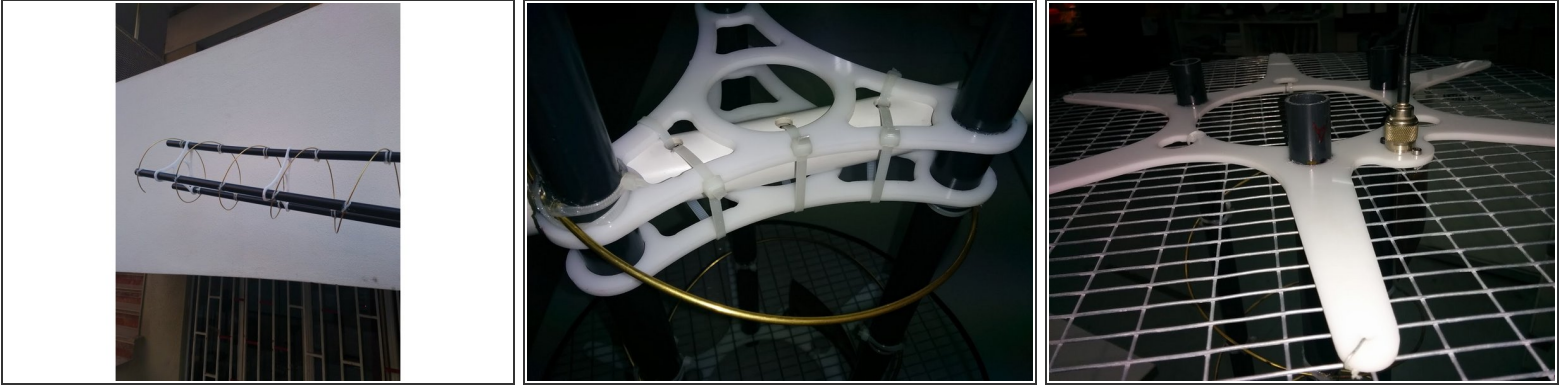
## Step 10 — N-type placement



- Place the N-type in position without screwing it. Cut, perforate and bend the triangular sheet of copper 0.5mm thick according to the design file provided. File the tip so it can be inserted in the N-type.
- Stabilize the brass wire on the copper triangular using small wires, and solder them.
- Insert the small tip of the triangular copper sheet in the N-type connector and solder.
- Screw the N-type on it's final position
- Check with a multimeter that there is no short between reflector & helix

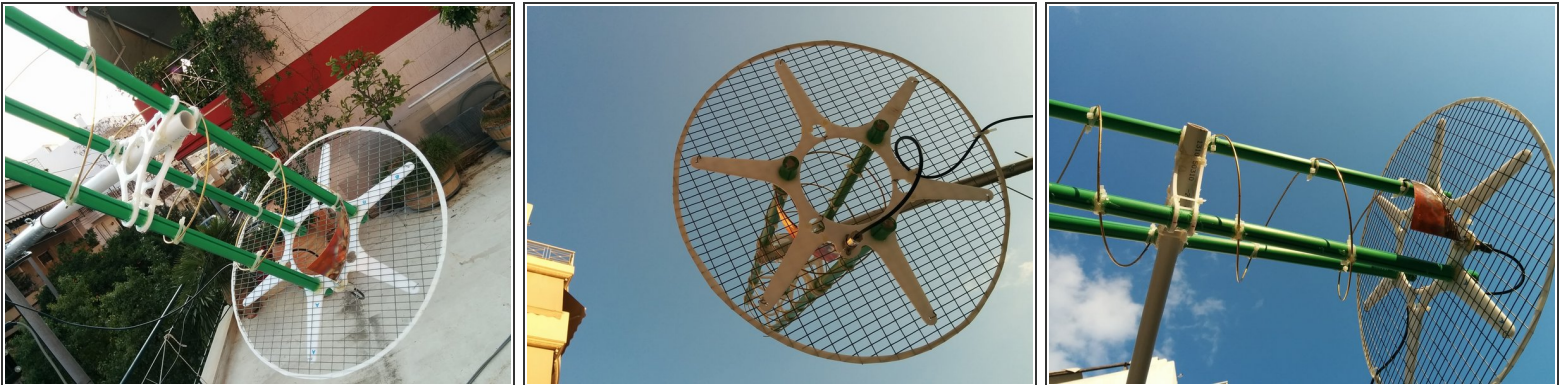


## Step 11 — Getting ready to finish up



- As soon as we are 100% sure everything is ok, cut the rest of the wire till you get a 5696mm length
- The final positioning is done on the plastic PVC pipe that has holes to tie up two plexiglass stabilizers.
- Connect the co-axial to the N-type

## Step 12



- The 3 following pictures are from established RHCP antenna on the rotator. Polypropylene pipes were used instead of PVC. The total weight is 2.4 kg.

Frequency 434 MHz

Turns 8

Weight: 2.2kgr

Circumference/Wavelength (0.75 - 1.33) = 1

Reflector Diameter/Wavelength (0.8 - 1.1)= 0,8

Turn Pitch/Wavelength (0.2126 - 0.2867) = 0,25

Wavelength ( $\Lambda$ ) 691 mm

Winding Diameter 220 mm

Winding Circumference 691 mm

Winding Spacing 172 mm

Winding Length 5696 mm

Reflector Diameter 553 mm

Boom Length: 1.379 m

Gain: 18.711 dBic

Half-Power Beamwidth: 36.806 deg