

EH- Antenna for the 20- meter Band

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Credit Line: http://ehant.qrz.ru/exp_eh1.htm

Below step by step will be described how to make a EH- Antenna for the 20- meter Band. So if you are ready- go ahead with me!

At the beginning we have to visit nearest Building Materials Store (**Note I.G.:** something like Home Depot).

For making of the antenna you need to buy:

Polypropylene Tube PP-H 32x1,8 DIN 4102 B1 (dia 32-mm and length 50- cm).

Cap for the Tube 32PP S-16 (just to fit to close the tube).

Copper foil two pieces by dimension 160-mm x 115- mm each (**Note I.G.:** In Canada I have seen such foil in local Craft Store).

Several screw for plastic (wood) in length 10- 15-mm and several screw in dia 3- mm and length 10- 15- mm with nuts.

3- meter length of insulated wire in dia 2-mm (12- 13- AWG) (**Note I.G.:** For Canada: Local Craft Store, Dollorama, Sayal, A- Z- Electronics).

If you could find buy a 2- meter length of main cable with stranded wires in 1.5- mm dia (14-16- AWG).

Do not forget find an RF- Socket in a special shop or your stock.



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For tuning of the antenna you will need:

SWR- meter. Field Strength Meter.

Spectrograph

Instead of Spectrograph you may to use: Powerful RF Generator or RF-Generator with RF- Bridge- for example, similar to MFJ- 259B.

For experimenting with the antenna you will need a Q- Meter and C- Meter.

So all above mention parts are sitting on the desk. It is possible to make the EH- Antenna.

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Making the EH- Antenna.

Figure 1 shows design of the antenna. Before the making of the antenna, please, carefully read all the article. Special attention should be taken to places that printed in the red color.

Take two copper sheets. Put it on to a plane surface. Clean by sandpaper sides in 160- mm long. Tin the sides by a soldering iron (100- Wtt would be good stuff). Clean up the flux. Tinned sheets roll up by the Polypropylene Tube on the plane surface.

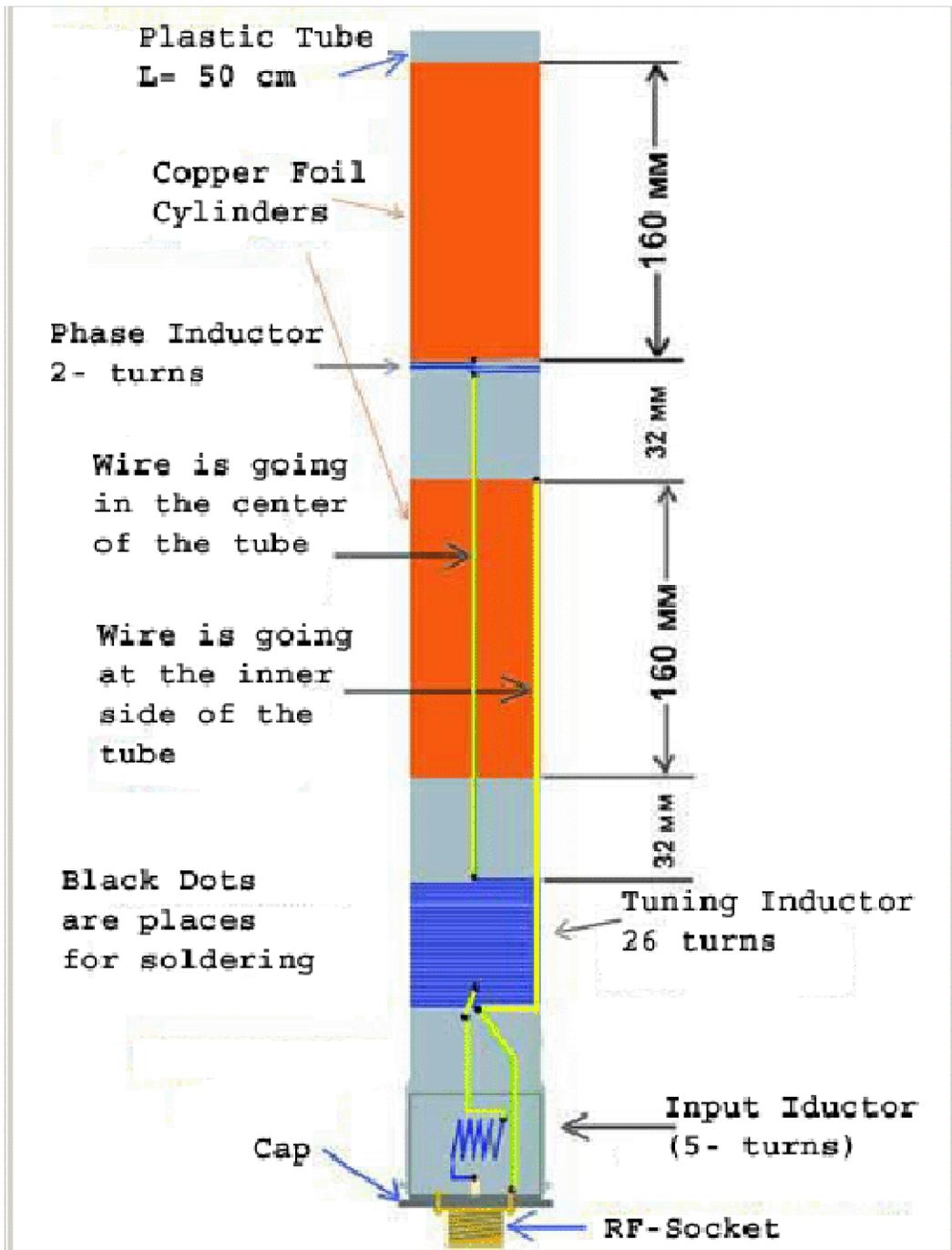


Figure 1 Design of the EH- Antenna for the 20- meter Band

Fist copper sheet turns around of the Polypropylene Tube and temporary hold by a length of wire. Distance from the upper end of the tube to the foil should be 15-20-mm. Take hot soldering iron and solder the sheet in 3- places. You need to do it fast because the plastic tube may be melted. Take wire for the phase inductor. Put wire to the seam and do soldering the foil on the full length.

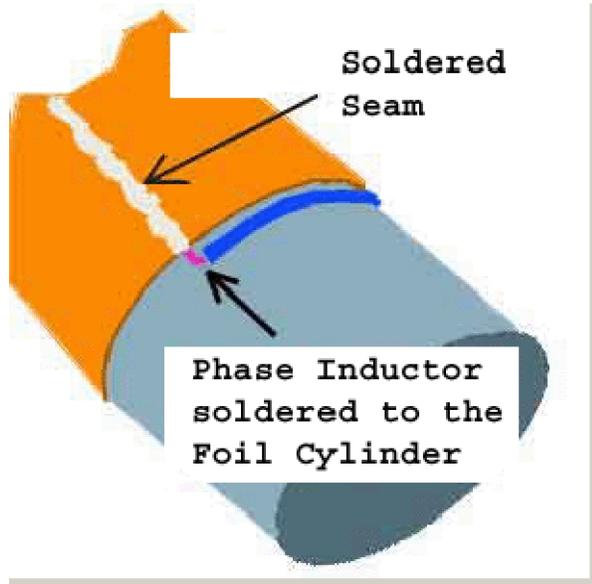


Figure 2 Soldering of the Inductor to the Upper Copper Cylinder

Take the second copper sheet. Do with it the same things as with the first one (to turn around of the plastic tube hold by pieces of wire and do soldering in several places). Pay attention that the second (lower) cylinder should be placed on the distance apart of the first cylinder equal to diameter of the tube. At our case it is 32- mm (see Figure 1).

Next step is to measure the capacity between the cylinders. I used to a surplus Russian device E9- 5. Figure 4 shows the measurement. At the design of the EH- Antenna the capacity between the cylinders should be near 7- pF. Knowing of the value is needed for us to calculate (according to W5QJR reference book) a tuning inductor. Below I give you a calculated by me data for the inductor.

Next step is to make the tuning inductor. The inductor is coiled by enamel strand wire in diameter 2- mm (12-AWG). Numbers of turns are 26 (calculated value) but I recommend to coil 28- 29 turns.

Phase inductor has 2- 3 (3 better) turns of the insulated wire. Turn around the tube coils of the inductor. Lower end of the inductor is inserted into the hole in dia 2-mm onto the tube. Do not forget to tin the end. Figure 2 shows soldering of the inductor to the upper copper cylinder. Figure 3 shows the ready phase inductor.

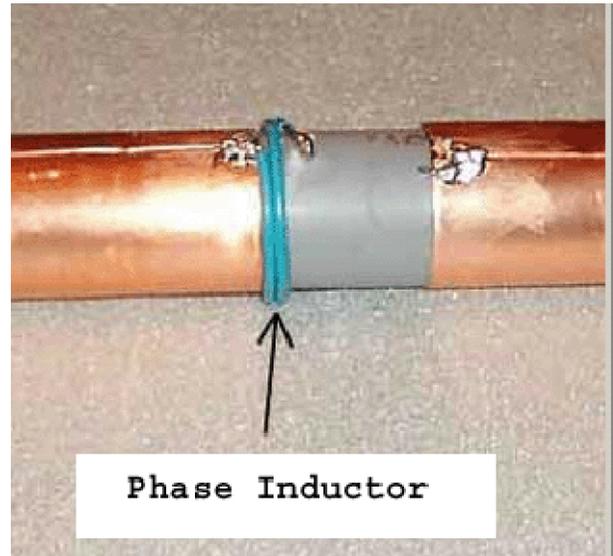


Figure 3 Ready Phase Inductor



Figure 4 Measure the Capacity between the Cylinders

It should be done for purpose of the tuning of the EH – Antenna because it is easy to remove the coils then to add those ones.

So, take the wire, straighten the wire. Take distance in 32- mm apart of the lower end of the lower cylinder. Do hole in 1.5- 2- mm in the plastic tube. It is possible to do with usual soldering iron. Tin one of the end of the wire on length 10- mm. Insert the tinned end into the hole. Coil 23- turns. (1) Do loop from the wire. Tin the loop. (2) Do one more turn. Do loop from the wire. Tin the loop. (3) Do one more turn. Do loop from the wire. Tin the loop. (4) Do one more turn. Do loop from the wire. Tin the loop. Then coil the last three turns. Then do hole in the plastic tube and insert in the hole the wire. **Figure 5** shows the tapped tuning inductor.

My advice: Coil first and last 3- turns with gap in 3- 4- mm between the turns. It would be useful at final tuning of the antenna. So the inductor should be look like it is shown on the **Figure 6**.

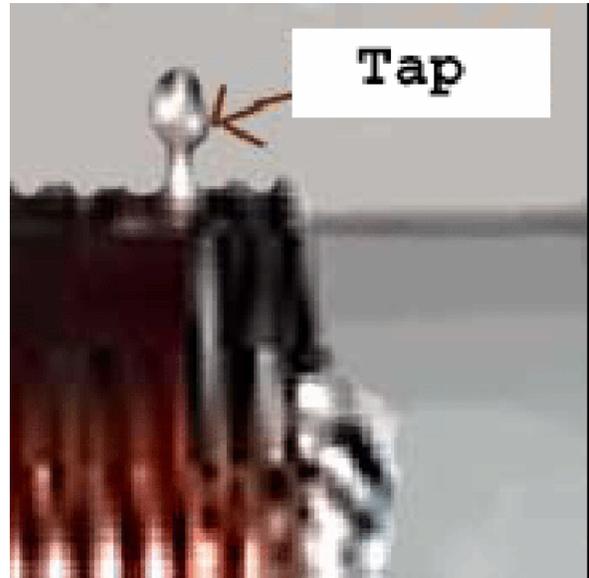


Figure 5 Tapped Tuning inductor



Figure 6 Tuning inductor with Gap between the Coils

Almost all parts are installed on the tube. Antenna almost is ready! **Figure 7** shows the antenna.



Figure 7 EH- Antenna

- 1. Copper Cylinders
- 2. Phase Inductor
- 3. Tuning Inductor
- 4. Tuning Part of the Inductor
- 5. Plastic Tube

Next step is to connect the antenna parts between each other. The stage requires patient and attention.

At first, connect by wire in plastic insulation the upper end of the lower cylinder with lower end of the tuning inductor. (See **Figure 1**) For this connection do holes in dia 2- mm near the upper end of the lower cylinder and lower end of the tuning inductor. Take the length of wire that a little more the distance between the holes. **The wire should go inside the tube and the wire should touch by all its length the inner surface of the tube.** Tin ends of the wire. Bend the tinned ends of the wire onto 90- degree. Then insert the tinned ends of the wire into holes. Use all tools that you can find or make. I personally used a wood stick with a slot. An end of the wire was inserted to the slot then the end was inserted into the hole. After that the end was bended and soldered to the cylinder. Then next end of the wire was inserted into the hole and straight away bended and soldered to the tuning inductor.

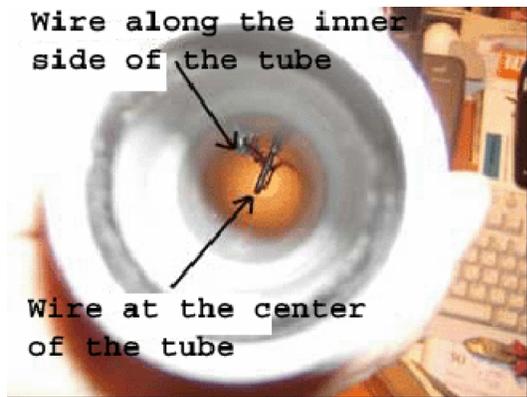


Figure 8 Wires inside of the Tube

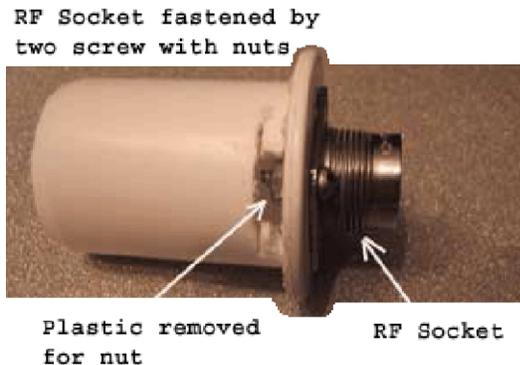


Figure 10 Tube Cap with RF- Socket

At second, connect by wire in plastic insulation the lower end of the phase inductor with upper end of the tuning inductor. (See **Figure 1**) Preliminary do the same things as was done with the first wire. **However the wire should go into center of the tube.** You may use some kind of spreader to keep the distance equal inside the tube. **Figure 8** shows the wires inside of the tube.

At third, last step to make the EH- Antenna. Install the cap with an RF- socket and an input inductor. **Figure 9** shows the cap. Do holes for fastened RF- Socket by screw with nuts and install this one. **Figure 10** shows the cap with the RF- Socket. Cut half part of plastic from the cap, install wires and input inductor. **Figure 11** shows the cap with the RF- Socket and the input inductor. Well, do not hurry to install the input inductor it should be installed after a preliminary tuning of the antenna. The inductor helps get the minimum SWR in the antenna. Tuning inductor may contain 5- 7 turns. Diameter of the inductor is 12- 15- mm. It made by wire in plastic insulation (similar wire that was used for the phase inductor). **The inductor must be placed perpendicularly to axis of the plastic tube.**



Figure 9 Tube Cap

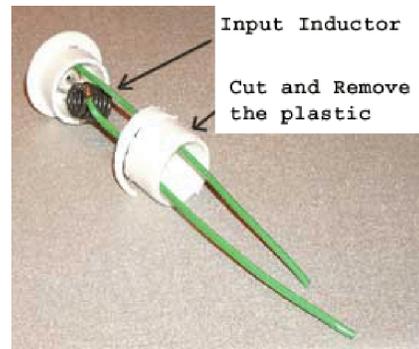


Figure 11 Tube Cap with RF- Socket and Input Inductor

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Do two holes in diameter 2- mm near the lower end of the tuning inductor. Pass through the holes wires from the input inductor and ground of the RF- Socket (Figure 11). Length of the wires should be allowed to remove the cap from the tube without desoldering the wires from the tuning inductor and RF- socket. It may be needed for adjusting of the input inductor. Then fasten the cap to the tube by screw.

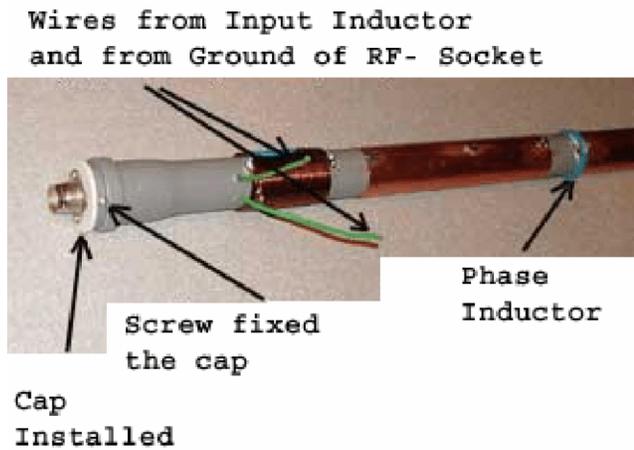


Figure 12 EH- Antenna with Cap.

All set! EH- Antenna is made!

Tuning of the Antenna

At the tuning process antenna should be hanged up in the way that any subject should be placed no more the 0.5- 1.0- meter apart from the antenna.

Initially it would be good to measure a resonance frequency of the antenna. Best way is to use an RF- Spectrograph with a screen. I used to a surplus Russian X1-50 spectrograph.

Several words are here about of using of the spectrograph. Almost any spectrograph has two pairs of terminals for analysis of the "Black- Box." First terminal is "Output" from where an RF is going.

Second terminal is "Input" to where the signal that came through the Black Box is going. So we need a Black Box with Antenna inside in it. For the Black Box I used to an RF- Bridge made by schematic of RZ4HK (Reference: Radio #1, 1980, p.22). Figure 14 shows the Bridge. Turn on the bridge to the spectrograph and turn on the antenna to the bridge.

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Figure 12 shows EH- Antenna with the cap. Wire going from the input inductor is initially soldered to the 4th- tap of the tuning inductor. Wire going from the ground of the RF- Socket is soldered to the lower end of the tuning inductor. Figure 13 shows the soldering to the tuning inductor.

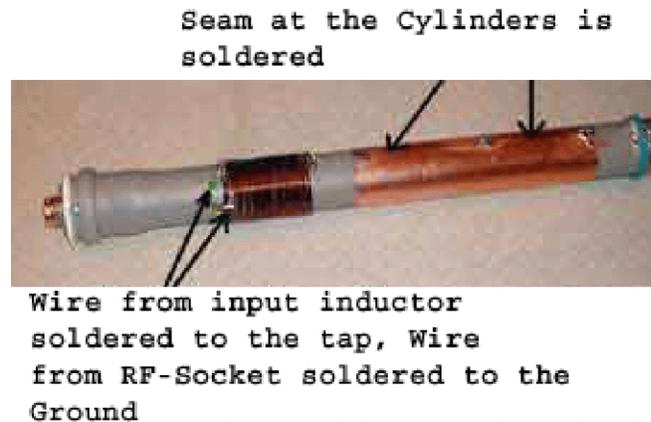


Figure 13 Soldering Wires to the Tuning Inductor.

Now it is possible to find with help of the spectrograph the amplitude frequency characteristic of the EH- Antenna. Figure 15 shows RF Bridge connected to the spectrograph. Figure 16 shows screen with the amplitude frequency characteristic of the EH- Antenna. EH- Antenna should be turn on straight away to the Bridge. RF Output and Input of the spectrograph may be turn on to the bridge by the Spectrograph's cables.

If the resonance frequency of the antenna is lower the 14.15- MHz turn by turn remove turns from the upper end of the tuning inductor. Stop on the frequency near 13.5-13.8 MHz. Then the tuning antenna into resonance it is possible to do by changing gap between the turns of the tuning inductor. After that turn on the EH- Antenna through SWR meter to the transceiver. SWR meter should be connected straight away to the EH- Antenna. Input inductor at the time should be closed. Change tap on the tuning inductor by minimum SWR. Figure 17 shows SWR Vs Tap at my EH- Antenna. Open input inductor. Change quantity of the turns or geometrical sizes of the inductor by minimum SWR. Check the resonance frequency of the antenna during the tuning.

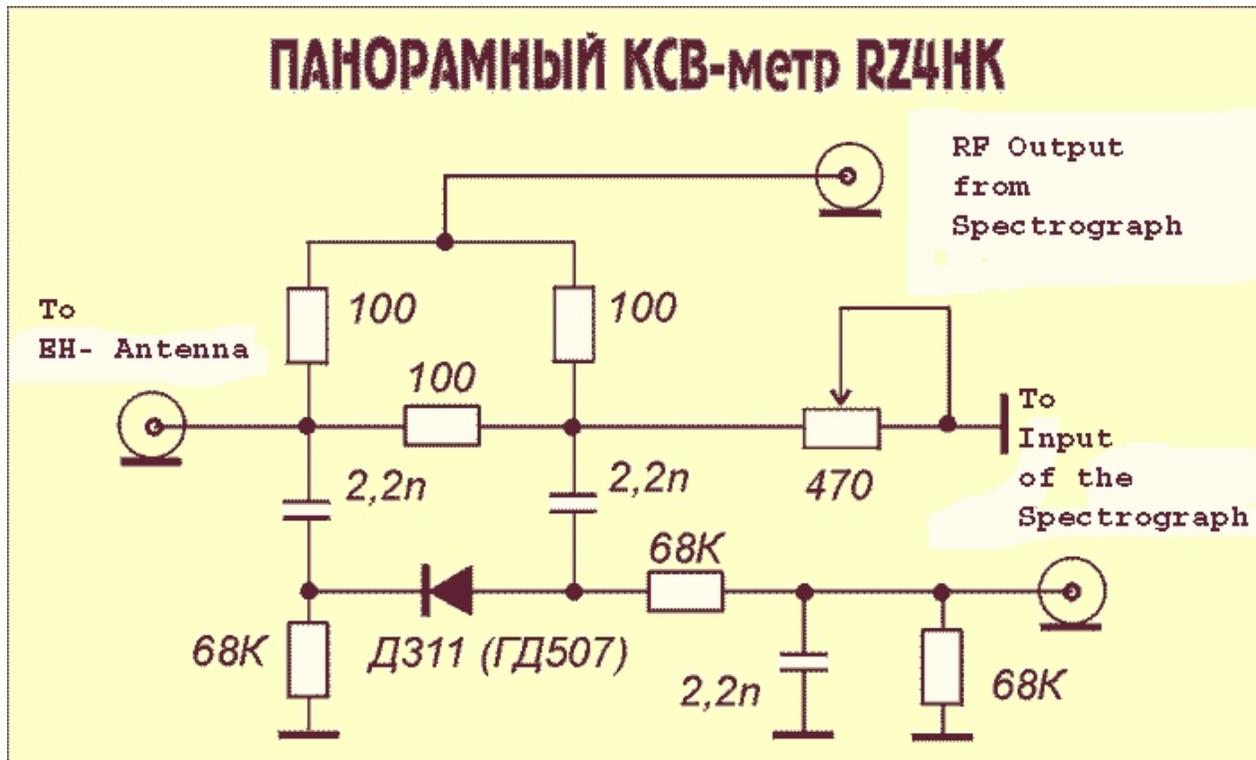


Figure 14 RF Bridge RZ4HK

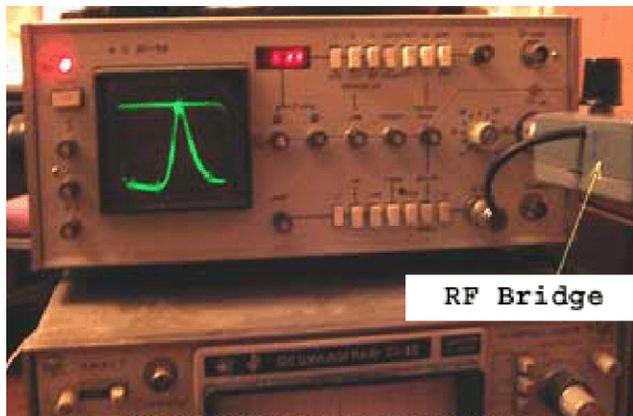


Figure 15 RF Bridge Connected to the Spectrograph

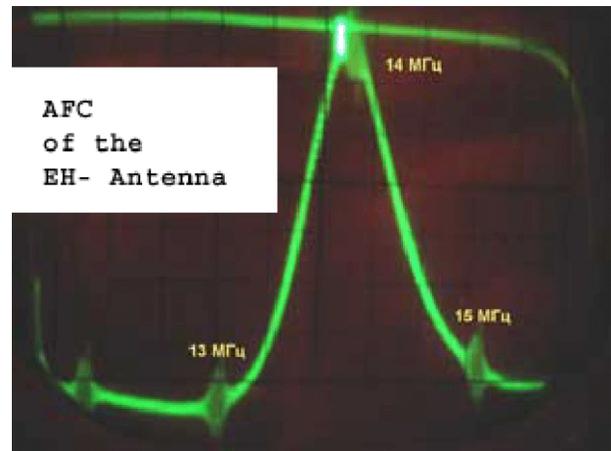


Figure 16 Screen with the Amplitude Frequency Characteristic of the EH- Antenna

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Be advised, that minimum SWR and maximum of the radiation power do not match in the EH- Antenna. If you would like to tune the antenna on to maximum radiation power use to FSM (Field Strength Meter) at the tuning. FSM should be placed far away from the antenna. However, 2- 3- meter is enough for that.

When tune the antenna by minimum SWR check the FSM. Find the compromising tuning when good SWR match to the maxima reading of the FSM.

Off course it is possible to use a MFJ- 259 (or something similar) for tuning the EH- Antenna.

If the EH-Antenna will be installed outdoor you should provide protection of the antenna against atmospheric impact. The simple solution is to place the antenna inside of a plastic tube diameter of 50- mm. EH- Antenna should be installed along center line of the tube. Resonance frequency of the antenna may be changed. To tune the antenna in the resonance install at the upper end of the protection tube a closed turn. The turn may be made of a strip of the copper foil (the same as used at the cylinders) in width 8- 10 mm. By changing location of the closed turn it is possible to tune the EH- Antenna.

Attention! Tuning of the EH- Antenna must be done at cold Antenna. You must remove RF power from the antenna! Dangerous high voltage may be present on the part of the antenna.

Practice of the EH- Antenna

For some reason I cannot install the antenna outside. So I hang up the antenna at the first floor of my apartment turn on transceiver and go ahead! EH- Antenna was placed only near 2.5- 3- meter above the ground. **Figure 18** shows EH- Antenna inside of my apartment. **Figure 19** shows view from the window of my apartment. **Table 1** shows some QSOs made with the antenna. I called the stations. I do not work on CQ. Almost all of stations replied to me from my first calling. My transceiver had output RF power 50- Wtts.

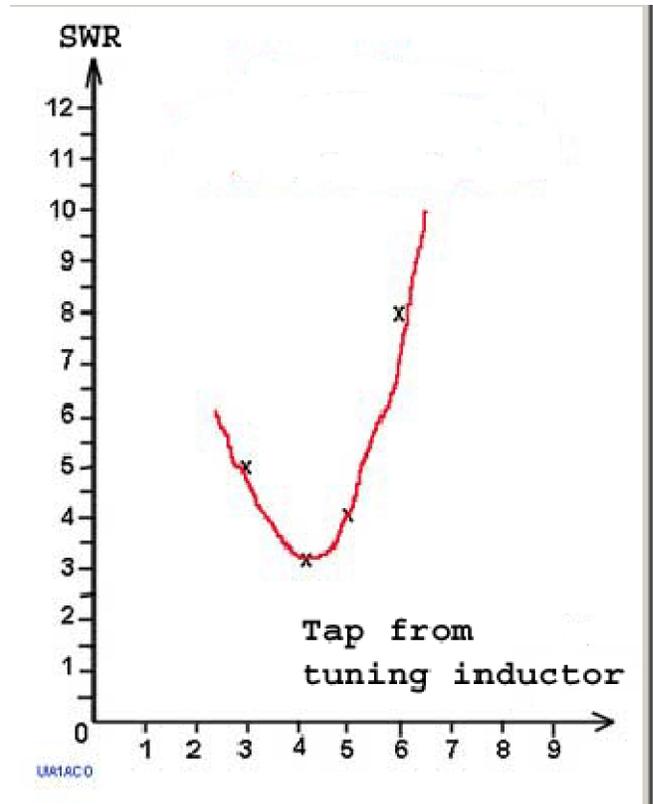


Figure 17 SWR Vs Tap at EH- Antenna



Figure 18 EH- Antenna inside of my Apartment

Conclusion:

EH- Antenna works not bad. RH- Antenna allows be on the Air from very tight conditions. I really did not expect it. Off course the antenna not so simple in the tuning. It takes some time and equipment. However at my location – first floor multistorey building- the EH- Antenna is only one that is really worked.

Wish you all the best in making EH- Antennas and looking for QSO in the Air.

73!
UA1ACO op. Vlad
St.-Petersburg

February- 2005

Additional redaction was done at February- 2010.



Figure 19 View from the Window of my Apartment

Table 1 Some QSOs made with the EH- Antenna

Date	Time	Mode	Call	RST send	RST rcvd
16.01.05	15-28	PSK-31	HG3IPA	599	599
31.01.05	10-11	SSB	UA1AKJ	59	55
31.01.05	10-48	SSB	UT5DF	57	59
31.01.05	10-59	SSB	UA3OO	59+25db	57
31.01.05	12-26	CW	HF2IARU	599	599
31.01.05	12-45	CW	RX3QZ	589	599
31.01.05	13-54	CW	RZ9SWR	589	599
31.01.05	14-08	CW	UR5YC	599	599
31.01.05	14-10	CW	UR5FEO/p/EU-180	599	599
01.02.05	13-35	CW	RA4HVX	599	589



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