Outdoor Window Mounted HF Helical Antenna

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In the far 90s it was installed and tested several outdoor HF helical antennas. About two designs of the antennas is the article. The antennas were mounted on the clothes drier installed at the first floor of the 9 story building. Height from the ground to the clothes drier was near two meter.

Helical HF antenna for the 40- meter Band

The antenna was installed on the clothes drier and was placed near 70 cm out of the concrete wall of the house. Form of the antenna was made from wooden sticks. The sticks were fixed by the nails to the wooden triangles. Each side of the wooden tringle had length of 30- cm. Length of the sticks was 2.3- meter.

The length of the helix form was defined by the length of the window where the wooden form was mounted. Stranded copper wire in 40 meter length and in 1- mm diameter (18- AWG) was wound above the form.

Window Clothes Drier

Wire in 3- meter length going from the helix to transceiver and wire in 1.2- meter length going from the helix to the capacitive load as well was included to this length. **Figure 1** shows design of the Window Mounted Helical Antenna.

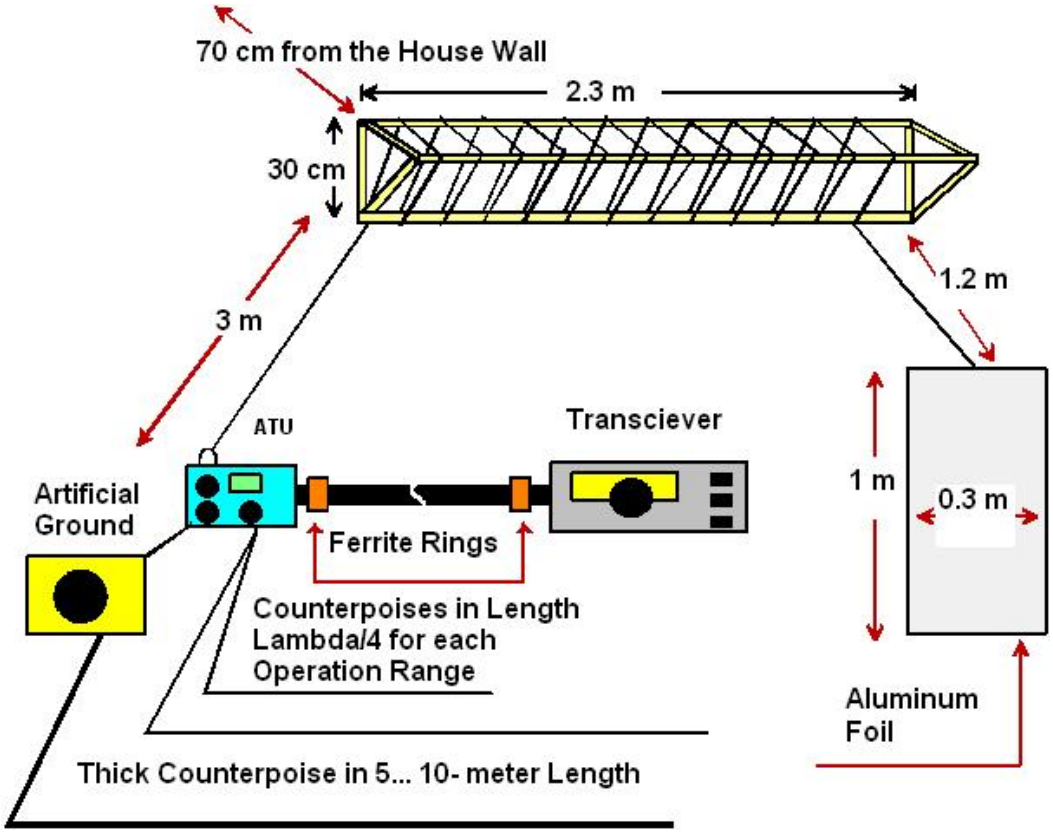

Figure 1 Design of the Window Mounted Helical Antenna

The antenna was intended for primary operation on the 40 meter Band. Therefore, after the installation, the antenna was tuned into the resonance at the frequency 7.05 MHz. BTW, the frequency is the second resonance frequency of the antenna, the first resonance frequency is lower the 3.5- MHz. It was used capacitive Load (made from aluminum foil) to tune the antenna to the 7.05- MHz. The top load had sizes 30 x 100- cm.

The foil was placed inside the room on the window to protect the foil from the atmospheric influences. The capacitive top load was connected to the helix with wire in length of the 120- cm. By changing length of the capacitive load it is possible to change the antenna resonance frequency.

The antenna had input impedance near 50- Ohm on the 7.05- MHz. The antenna had SWR 2:1 at the 7.0- MHz and at the 7.1- MHz. However the ATU (**References 1**) did the job to make SWR 1:1 on the all of the 40- meter band. As well the ATU allows use the antenna on the 160, 80, 30 and 20- meter Band. Anyway, the antenna may be connected to the transceiver directly through the 50- Ohm coaxial cable on the 40- meter Band.

On the others bands the antenna should be connected to the transceiver through ATU. Ferrite rings (or RF Choke- 5- 10 turns of the coaxial cable in diameter 5- 10- cm) should be installed on the both ends of the coaxial cable.

Window Mounted Helical Antenna with Tuned Helix

Tests of the Window Mounted Helical Antenna from **Figure 2** showed the high efficiency of the antenna. The operation of the antenna was good especially at its resonance frequency on the 40- meter band. Therefore I did experiments with helical antennas with changeable resonance frequency. The simple method to change the resonance frequency of the helical antenna is to change the length of the wire included to the radiation part of the antenna, or, just connect to different turns while switching the operation band.

It was made two version of the helical antenna. One has length of the wire used in the helix equal to 45 meter. The antenna may tune to the resonance at the 80, 40 and 30- meter band. Another version has length of the wire used in the helix equal to 22 meter. The antenna may tune to the resonance at the 40, 30, 20 and 17- meter band. **Figure 3** shows the design of the helical antenna.

If the antenna will not be used on the 160 and 80- meter Band then the length of the wire may be decreased to the 20 meters (included three meter to the ATU and 1.2- meter to the capacitive load). In this case the antenna will operate on the 30, 20 and 15- meter Band. Antenna as well is tuned to the resonance at the 40- meter band by changing length of the capacitive load.

The Helical antenna needs good grounding for the efficiency operation. The grounding may be included at least one counterpoise in lambda/4 length for each operation range of the antenna. Additional tuning for the grounding it could be provided with help of device Artificial Ground (**Reference 2**). Thick wire in length of 5- 10 meters should be connected to the device as the tuned counterpoise. The wire should have good insulation and hidden from pets. The counterpoises may be placed on the floor or placed inside the wall of the house.

The ends of the counterpoises should be insulated and prevented from access of the pets because a high RF voltage may be presents on the ends at the working of the antenna to transmit.

Antenna works good on the 40 meter band and satisfactory on the all other bands where ATU may tune the antenna to the 50 Ohm. Antenna was tested in summer month and was demolished before winter.

The multi band helical antenna consists of a helix with an aluminum ski stick in length of 1.5 meter connected to the end. The ski stick is a capacitive top load of the antenna. With help of a rotary switch the feeding coaxial cable connected to the part of the turns where the helical antenna has the resonance on the chosen band. On the resonance frequencies the antenna has input impedance near 50 Ohm. It allows fed the antenna through 50- Ohm coaxial cable without any ATU. However the antenna needs good grounding. It is influenced on the input impedance. I used grounding that was described in the first article. **Figure 3** shows design of the helical antenna with tuned helix.

The antenna was mounted on the clothes drier installed near wooden window frame and was placed near 100 cm out of the concrete wall of the building. Form of the antenna was made from wooden sticks. The sticks were fixed by the nails to the wooden triangles.

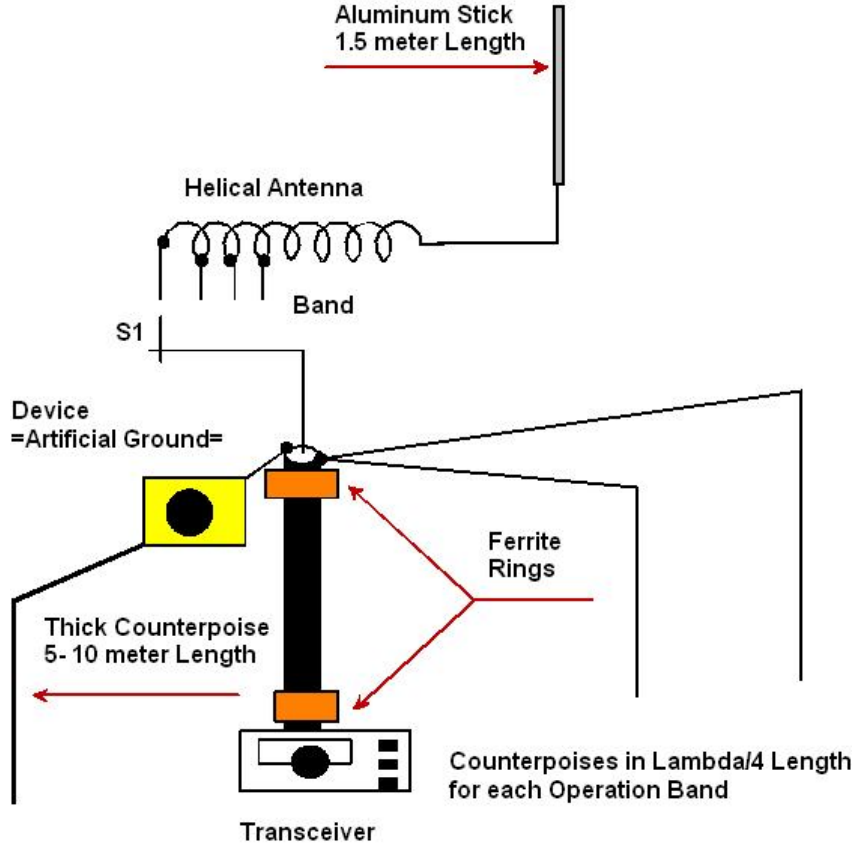

Figure 2 Helical Antenna with Switching Turns in the Helix

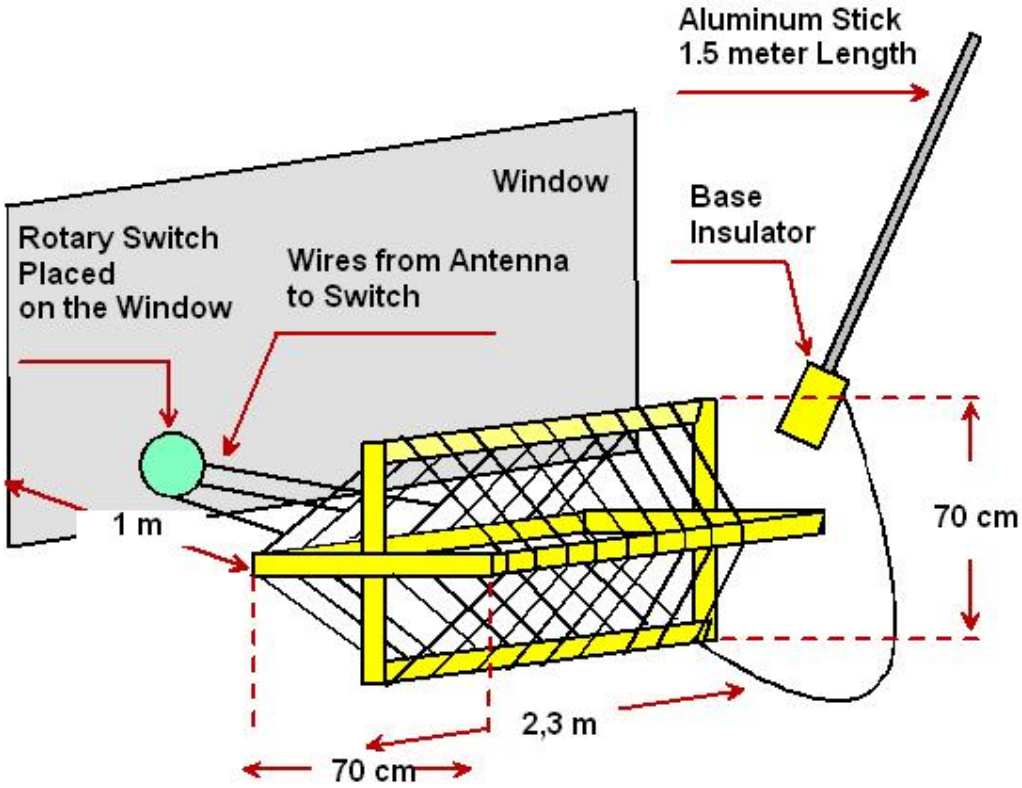

Figure 3 Design of the Helical Antenna with Tuned Helix

The antenna was mounted on the clothes drier installed near wooden window frame and was placed near 100 cm out of the concrete wall of the building. Form of the antenna was made from wooden sticks. The sticks were fixed by the nails to the wooden triangles.

Each side of the wooden tringle had diagonal of 70- cm. Length of the sticks was 2.3- meter. Aluminum stick was installed on the wall of the building on the old antenna insulator from VHF radio. I used chip bare aluminum wire in diameter of 2- mm. For me it was very convenient to use the bare aluminum wire because it was possible very easy to connect to the wire to find resonance of the antenna on the desired bands. **Table 1** shows length of the helix where the helical antenna has resonance at the amateur bands.

Table 1 Length of the Helix where the Helical Antenna Has Resonance

Band, m	Helix with Length 45 meter		Helix with Length 22 meter	
	Length of the Helix, m	Harmonic Frequency of the Helical Antenna	Length of the Helix, m	Harmonic Frequency of the Helical Antenna
80	45	1	-	-
40	44	2	22	1
30	35	2	17	1
20	-	-	20	2
17	-	-	18	2

When the helical antenna with grounding is installed and coaxial cable (do not forget about RF chokes on the both sides of the cable) is placed from the antenna to the transceiver, the helical antenna should be tuned to the resonance on the desired bands. It is very simple to find the resonance frequency of the antenna with help of RF-bridge. By choosing the tap from the antenna find the resonance frequency of the antenna. Device Artificial Ground helps eliminate the antenna reactance. So, it is needs two steps- first choose the tap, then, mark the tuning on the device Artificial Ground where the helical antenna has exactly resonance.

It is possible straight away connect to the taps shown in the **Table 1** and then tune the antenna in the resonance with help of shortening capacitor or lengthening inductor. If the helical antenna has the resonance lower the desired frequency in serial with the antenna turn on a shortening capacitor, if the helical antenna has the resonance higher the desired frequency in serial with the antenna turn on a lengthening inductor.

However, helical antenna tuned to the resonance with help of a shortening capacitor or lengthening inductor has narrow passband compare to antenna tuning by choosing tap.

The helical antenna is sensitive to position of the counterpoises and coaxial cable going from antenna to transceiver. So after tuning the antenna the things should be unchangeable in the place.

Antenna was installed at the first floor of the 9- story building. Antenna was tested in the Air and showed good result. However, I used the antenna (second variant, with helix in 22- meter length) only one month. Then the antenna was demolished because it was too bulky and prevent from drying the clothes (and curiosity of my neighbors)…

References

1. http://www.antentop.org/qrp.htm

2. http://www.antentop.org/024/ZS1JHG_024.htm

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