Multiband Vertical Stub Antennas

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Credit Line: http://www.cqham.ru/ant97_64.htm

Before describing of the antennas I would like to talk why those ones were designed. At fall 2009 the Youth Collective Radio Station RK9QWN had to change room inside the building. Old antennas were removed because the roof was repaired. So it needed to install new antennas.
The question was- what should be the antennas like?

Once night I was digging up models of antennas bundled with Antenna Simulator MMANA – GAL (may be loaded free, see **Reference 1**) and thinking about antennas for limited space. Among butch of the antennas I found of an interesting antenna for the 20- meter Band (model /ANT/Match/Short-Gamma-dipole.maa from the Antenna Simulator MMANA – GAL).

It is very interesting antenna. In **Reference 2** Igor Goncharenko treats the antenna like a limit case for shortening dipole with gamma matching (when the gamma matching equal to the length of the shortening antenna). At the other side it is usual stub dipole. For future development of the antenna please take attention that the dimensions of the antenna would be resonance at 10- meter Band. On the base of the two antennas was designed my antenna for two Bands- the 20 and 40- meter. **Figure 1** shows design of the antenna.

MMANA file may be downloaded from:
http://www.antentop.org/015/ ant_1.maa

Adjusting and Matching of the Antenna: Antenna has input impedance 150 Ohm at the 20- meter Band. At the Band antenna is tuned in to resonance by the height. At the 40 meter Band antenna is tuned to resonance by the capacitor C1 (see Figure 1). At the 40- meter it is possible to play with input resistance of the antenna by changing wide between the antenna wires. C1 just compensated the antenna reactance. Relay K1 is switched ON/OFF the capacitor that is provided the changing of the antenna Band.

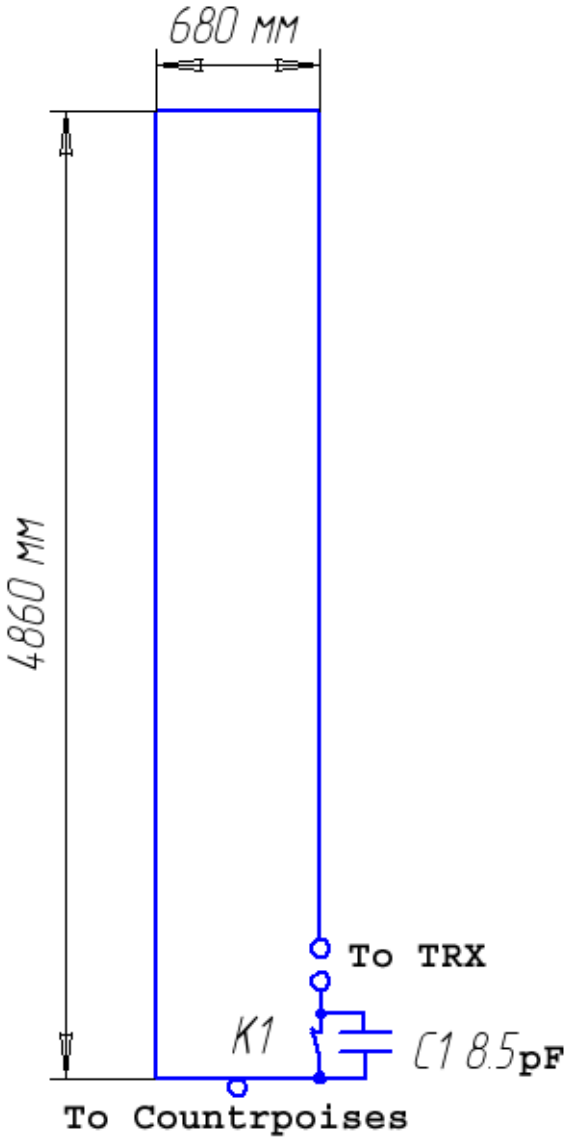

Figure 1 Vertical Stub Antenna for 40 and 20-meter Band

Disadvantage of the antenna (**Figure 1**) is not smart design. It is needed at least two spacer to build the antenna. So it was created antenna without any spacer. **Figure 2** shows the design of the antenna. Parameters of the antenna (**Figure 2**) are almost equal to the antenna shown on **Figure 1**. Disadvantage of the antenna (**Figure 2**) is that the base distance is almost twice more longer with antenna from **Figure 1**.

MMANA file may be downloaded from:

http://www.antentop.org/015/ ant_2.maa

At the 40- meter Band the antenna has some disadvantages. First is the narrow bandwidth. As usual the bandwidth is not more then 60- kHz at SWR 2.0:1. Satisfactory SWR may be reached only at one portion (CW or SSB) of the 40- meter Band. But the disadvantage is common for all types of the shortening antennas. The problem may be solved if it would be used additional relay to switch two matching capacitors- one for CW portion and another one for SSB portion of the 40- meter Band. Next disadvantage (that is also common for shortening antennas) is less gain with lambda/4 vertical antenna. However the gain of the antenna would be only less in 2- dB compare to lambda/4 vertical antenna.

So what is about a multiband antenna that is in the header? There is still spoken only about two Bands antenna. **Figure 3** corrects the situation.

MMANA file may be downloaded from:

http://www.antentop.org/015/ ant_3.maa

The antenna works at 15 and 10- meter as Open Sleeve" antenna. Such design already was done by me and written off in **Reference 3**. It is possible to add wires for WARC as it was made for 15 and 10- meter Bands. Additional wires between gamma match and antenna wire (it is only for 40- meter Band) provide screening this antenna parts one against another. It allows decrease distance between the parts. So there is needed smaller spacer. By me was used spacer in 450- mm length.

Adjusting and Matching of the Antenna: For tuning the antenna it should be used a SWR- Bridge or usual SWR- Meter.

At the 20- meter Band the antenna is tuned in to resonance by the height. At the 40 meter Band antenna is tuned by several steps.

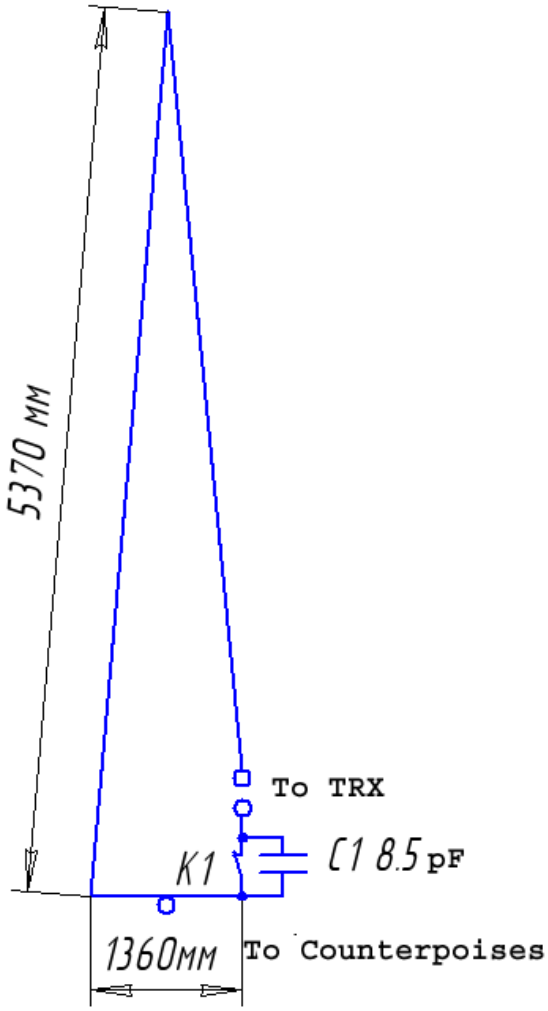

Figure 2 Vertical Stub Antenna for 40 and 20- meter Band without Upper Spacer

At first antenna is tuned by the capacitor C1 (see **Figure 3**). Then antenna is tuned fine by changing width. Then antenna again is tuned by C1 and tuned fine by changing width. It is needed several step to have the antenna tuned. After the antenna is tuned to 20 and 40- meter Band the 15 and 10 meter Band should be adjusted. It should be made just changing length of the proper to the band wire.

Antennas shown on **Figure 1**, **Figure 2** and **Figure 3** were simulated in MMANA in case to be installed those ones close to the ground (or equivalent of the ground- metal or concrete roof). For the installation several (the more the better) non- resonance counterpoises (4- 6 meter length) may be used with the antenna.

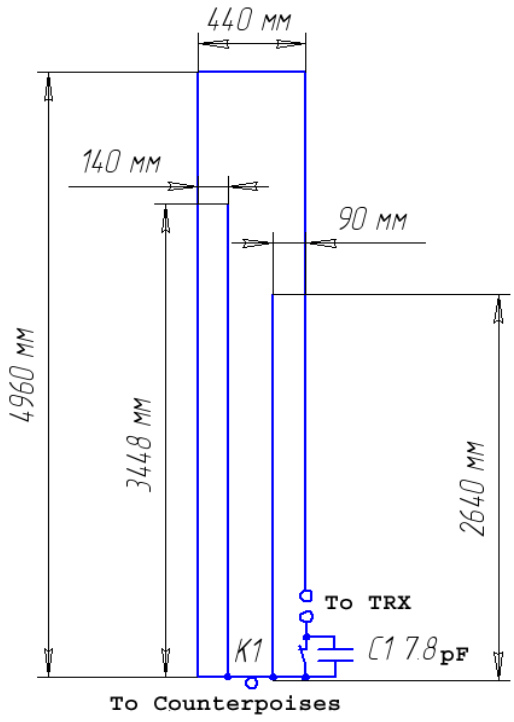

Figure 3 Vertical Stub Antenna for 40, 20, 15 and 10- meter Band

The antennas may be installed at height near one meter above the ground. Resonance counterpoises should be used at this placement. Dimension of the antennas should be slightly corrected if installation at more the one meter above the ground is planned. **Figure 4** shows antenna from **Figure 1** that is recalculated for free space.

MMANA file may be downloaded from:
http://www.antentop.org/015/ ant_4.maa

Described above antennas may be made from strand copper or aluminum wire in diameter 1.5- 2.0- mm (15- 12- AWG).Wire in plastic insulation may be used as well however the antennas size should be decrease approximately on 2.4% because shortening coefficient of the wire.

Below there are several words about feeding of the antennas.

I suggest do matching of the antennas with coaxial cable with help of transformer on ferrite tubes, so called “binocular transformer.” It is possible to find lots stuff about the “binocular transformer.” I suggest **References 4** and **5**.

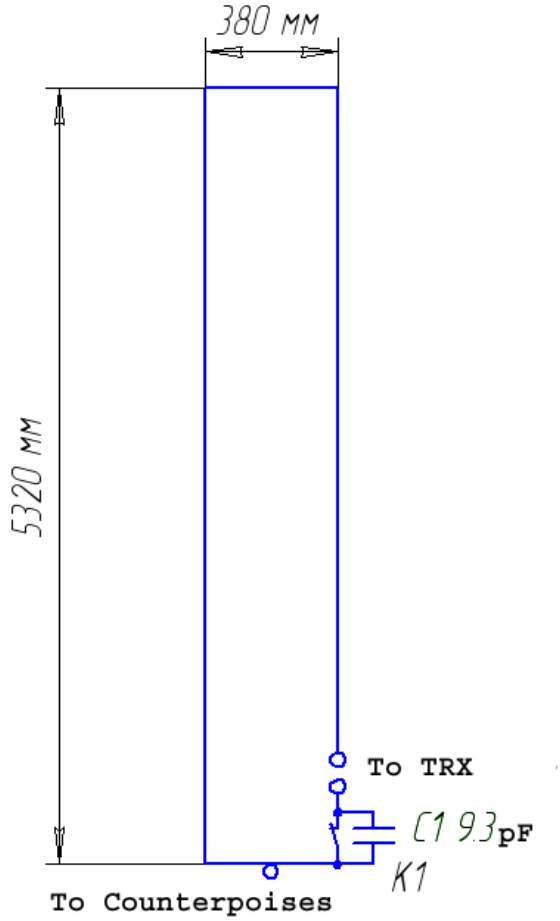

Figure 4 Vertical Stub Antenna for 40 and 20- meter Band calculated for free space

Transformer may be installed straight away at antenna terminals and use coaxial cable to feed the antenna. Antenna may be fed by two wire ladder line and the transformer may be installed at the shack.

References:

1. Antenna Simulator MMANA- GAL (try Google engine for best result)
2. Igor Goncharenko: HF and VHF antennas. Part II. Fundamentals and Practice – Moscow, : Radiosoft, magazine "Radio", 2006.

3. Roman Sergeev: 8- Band Asymmetrical Dipole Antenna – Moscow, magazine Radio, 2008

4. Semichev B: Ferrite RF transformers – Moscow, magazine Radio, 2007. # 3, pp.: 68- 69.

5. ***http://cqham.ru/ant78_71.htm***

73! Roman Sergeev (RN9RQ)