# MULTIRANGE VERTICAL ANTENNAS

*Igor Grigorov, RK3ZK*
antentop@mail.ru

## *A combined three-band antenna*

**Three band antenna fundamentals:** At a lack of the place for installation of a separate vertical antenna for each of three upper HF ranges it is possible to use a combined three-band antenna that works at the ranges itself. **Figure 1** shows schematic of a combined three-band antenna.

**Figure 1** A combined three-band antenna

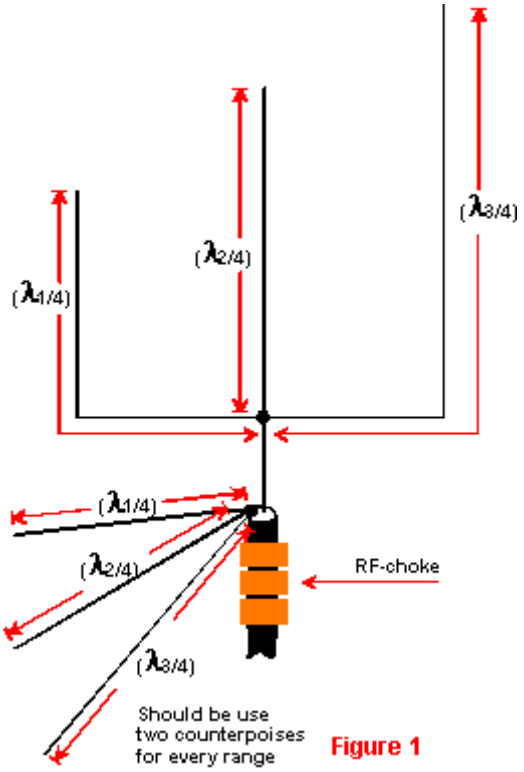


Figure 1

The antenna consists of from three quarter-wave verticals that are resonated for each of working ranges. The verticals are connected in the bottom together. Two quarter-wave counterpoises should be use for each operation range of the antenna A coaxial cable with 50-Ohm characteristic impedance will do well for the antenna. A coaxial cable with 75-Ohm characteristic impedance also would be work with the antenna, but a SWR in the coax will be higher compare to 50-Ohm coaxial cable. **Table 1** shows the combination of ranges where a mutual influence of vibrators against each other is minimum.

**Design of the Antenna:** Three various designs of the three- range antenna are shown below. **Figure 2** shows a simple design suitable for 6 - to 15-M. The three vibrators are placed on a small distance from each other. The distances between the vibrators are fixed with the help of small plastic insulators. The design has very strong mutual influence for every vibrator against each other.

**Table 1**

| | | |
|---|---|---|
| 6m | 10m | 15m |
| 10m | 15m | 20m |
| 12m | 17m | 30m |
| 15m | 20m | 40m |
| 15m | 17m | 20m |
| 20m | 30m | 40m |
| 30m | 40m | 80m |
| 40m | 80m | 160m |

**Figure 2** Simple design of a three ranges antenna

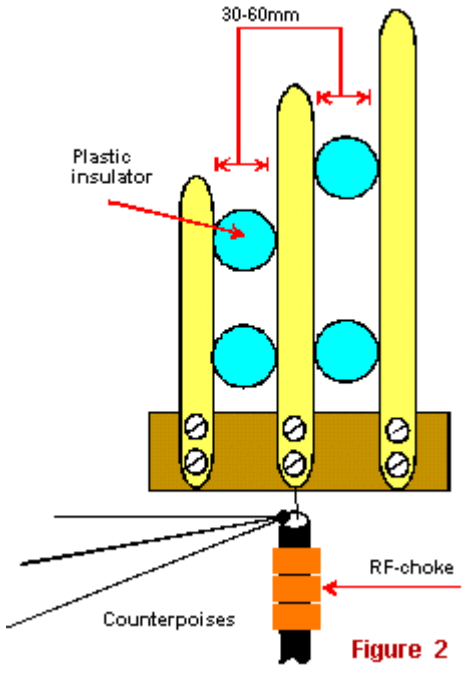


Figure 2

**Figure 3** shows a simple design suitable for 6 - to 17-M. Antenna has the triangular shape. Special 'sitting' should be used for the antenna design. Vibrators are screwed in the bottom with the help of strong screws. The design has a small mutual influence for every vibrator against each other.

**Figure 3** A triangular shape antenna design

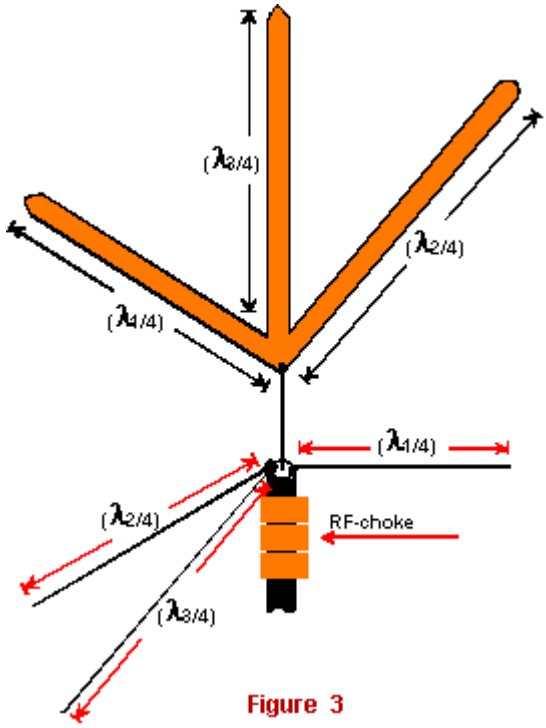


Figure 3

**Figure 4** shows a simple design suitable for 6 - to 30-M. Vibrators are screwed to a strong metal angle.

**Figure 4** A three range antenna on a metal angle

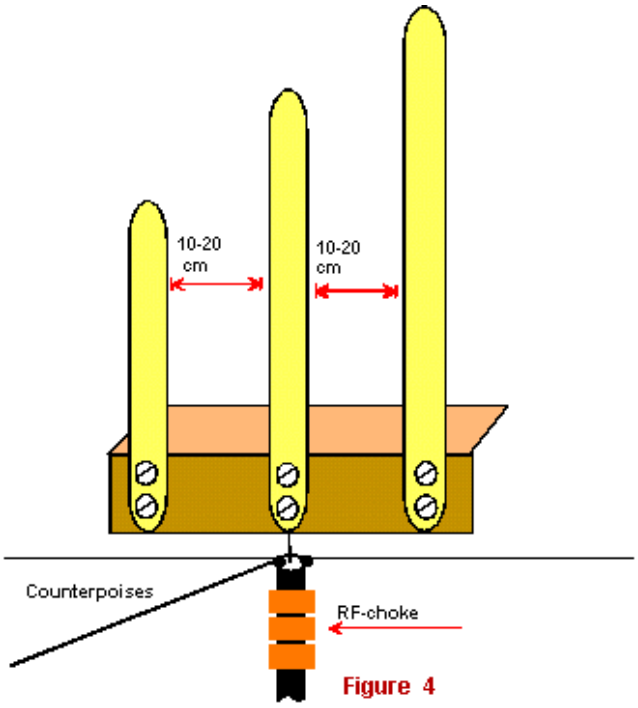


Figure 4

## Multirange Vertical Antennas

Distances between the vibrators are 10 -30 centimeters. It is decrease the mutual influence of the vibrators to each other.

**Antenna Adjusting:** The antenna is adjusted by changing lengths of the vibrators. It is not complicated. One way is to move vibrators relatively the metal base, as it is shown in **Figure 5**. Do it carefully, because the vibrators have mutual influence to each other. It needs to do additional holes on to end of the vibrators for realization of the way. It is possible to do one of the vibrators. This method always gives a good result.

**Figure 5** A three range antenna adjusting

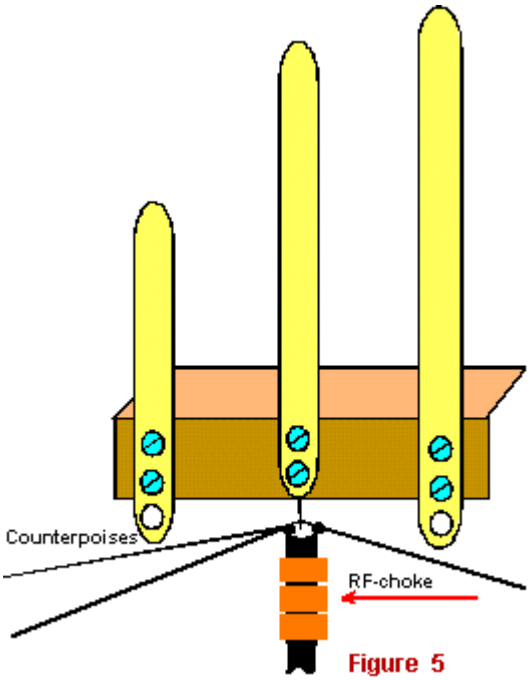


Figure 5

Other way is to change lengths of the upper ends of the vibrators. The vibrators ends made from thick copper or aluminum wire. The wire may be shortened, move in the side, as it is shown in **Figure 6**. But at the way an amateur must have access to ends of the antenna.

## A three ranges antenna for the low ranges

**Figure 7** shows a simple design suitable for 40 - to 160-M. Vibrators made from a copper wire in diameter 1 to 2 mm. Vibrators have length (λ/4)*1.1. Each vibrator is matched with coaxial cable with help of its own a 'shortening 'capacitor. The shortening capacitor can have 100-pF at ranges of 6- to 17-M, 150-pF at ranges of 20- and 30-M, 200-pF at ranges of 40-80 meters, 250-pF at 160-M. The shortening capacitors should be placed in a whether- proof box.

**Figure 8** shows another simple design suitable for 40 - to 160-M. Vibrators made from a copper wire in diameter 1 to 2 mm.

**Figure 6** A three range antenna tuning with the help of thick wire

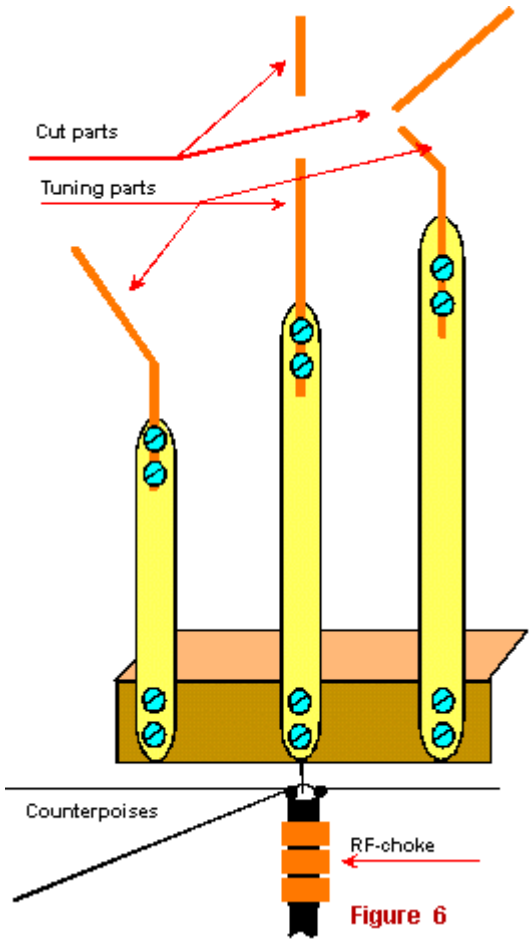


Figure 6

Vibrators have length (λ/4)*(0.5-0.9). Each vibrator is matched with coaxial cable with help of its own a 'lengthening' coil. You can use this design if you have a lack of place.

It is not wise to use more than three vibrators for a multi- range vertical antenna, because overall efficiency of the antenna drops in this case. Such multi- vibrators antenna will be too complicated at adjusting.

**Remember:** Two and more resonance (a quarter wave) counterpoises for each operation range of the antenna should be used. However, if the antenna is placed at a small altitude above a metal roof and the braid of the coaxial cable has a good electrical contact with the metal roof, the antenna could be used without any counterpoises.

**RF – choke should be used:** An RF- choke on the coaxial cable should be installed at feeding terminals. . The RF-choke precludes leaking of RF- currents on to outer braid of the coaxial cable. Without the RF-choke the outer braid of the coaxial cable serves as a radiating part of the vertical antenna. It gets to TV and RF- interferences when the antenna operates on transmission. 10 - 30 ferrite rings (permeability does not matter) hardly dressed on the coaxial cable end at the antenna terminal make the RF-choke.

**Figure 7** A simple design suitable for 40 - to 160-M

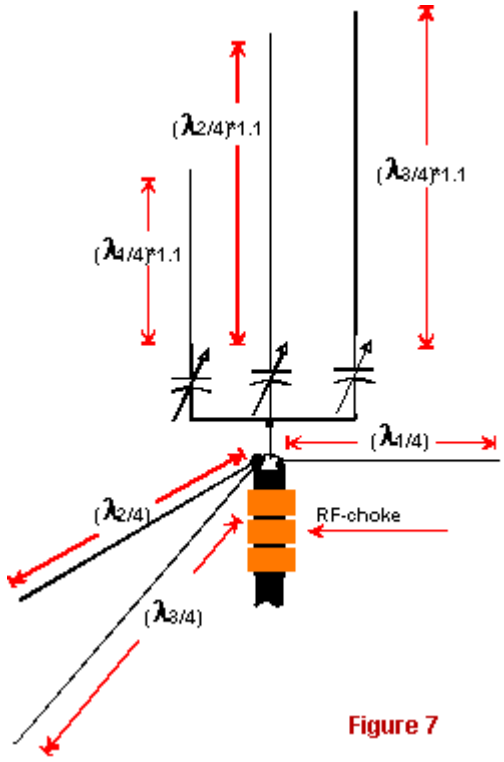


Figure 7

**Figure 8** A simple design suitable for 40 - to 160-M with 'lengthening' coil

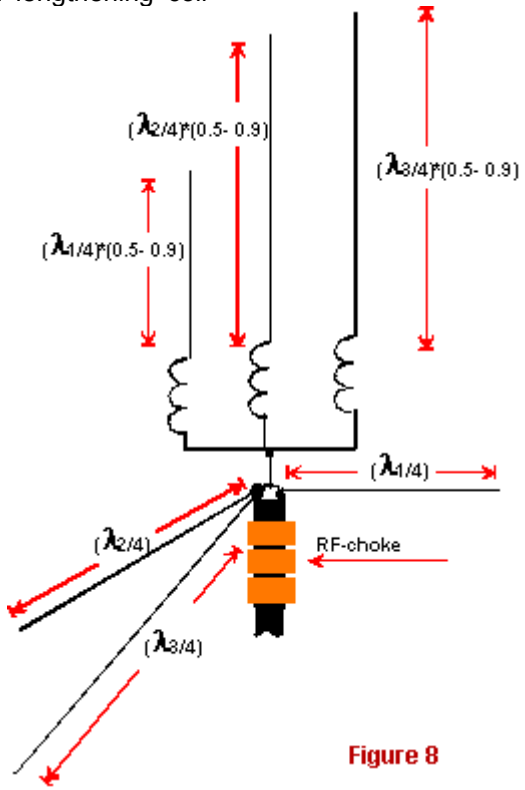


Figure 8