Compact Cage Antenna

Vladislav Shcherbakov, RU3ARJ,
ru3arj@mail.ru

Credit Line: www.cqham.ru

Everyone knows “classical” quad antenna. Its perimeter is equal to wavelength. Each side of the quad is 1/4 wavelength.

Amplification of the “classical” quad antenna is 3-dBi, input impedance (in a free space) is close to 120-Ohm **(Figure 1)**. Good antenna but the size!

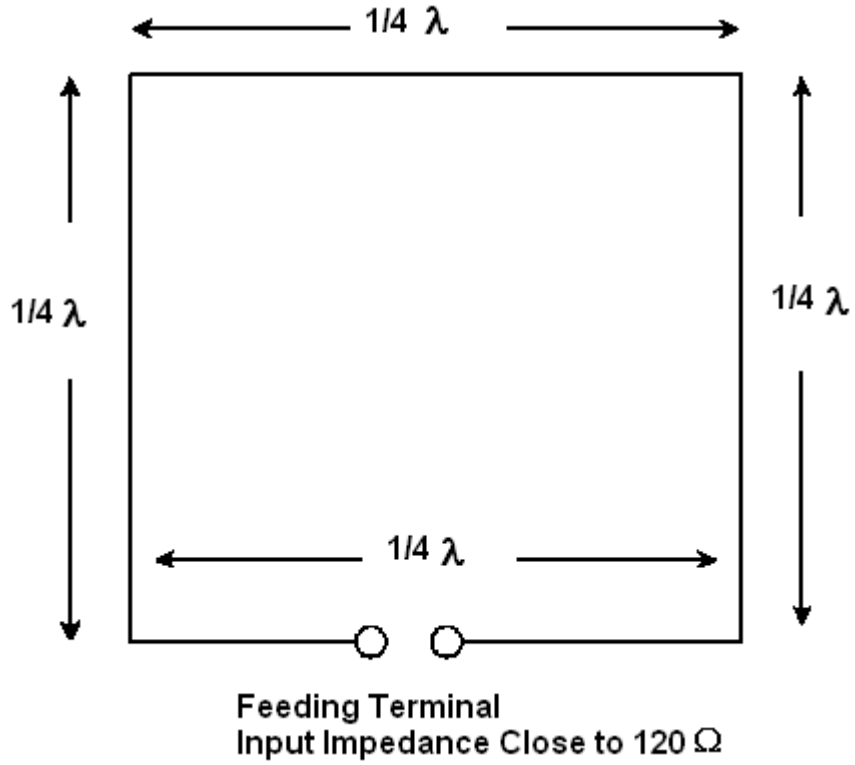


Figure 1. “Classical” quad antenna

It is possible to reduce its size by folding it in a “cage” shape. The simplest cage in which the antenna may be transformed is a cage of 10 sections 0.11 wavelength each. The Compact Cage Antenna (CCA) gain is 1.5-dBi and input impedance is close to 50-Ohm. **Figure 2** shows the CCA grabbed from MMANA. There are shown antenna currents and the source. MMANA file for the antenna (named Trihat- quad) may be found at MMANA “Antenna Library“ (**References 1**) or loaded by the link below.

Figure 3 shows free space radiation patterns for Compact Cage Antenna, **Figure 4** shows Compact Cage Antenna radiation patterns at 1/3 wavelength height above the ground, **Figure 5** shows Compact Cage Antenna radiation patterns at 1.0 wavelength height above the ground.

Compact Cage Antenna may be fed at the low corner with the twin line (see **Figure 6**). The antenna may be fed with coaxial cable through a balun as well.

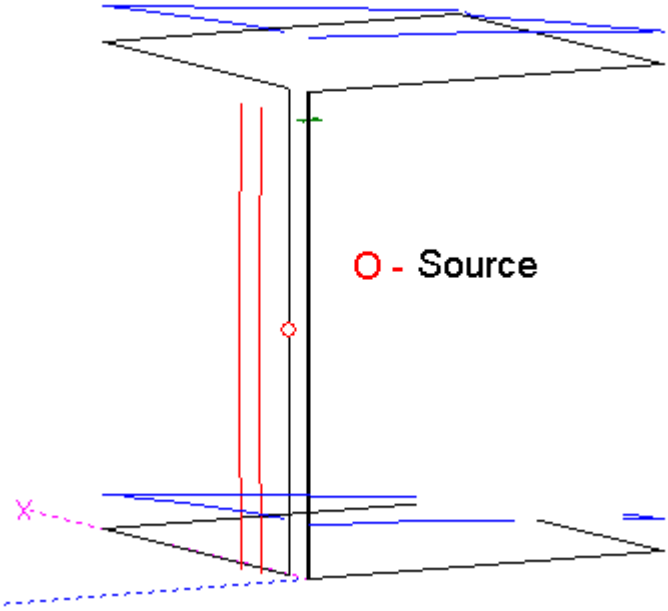
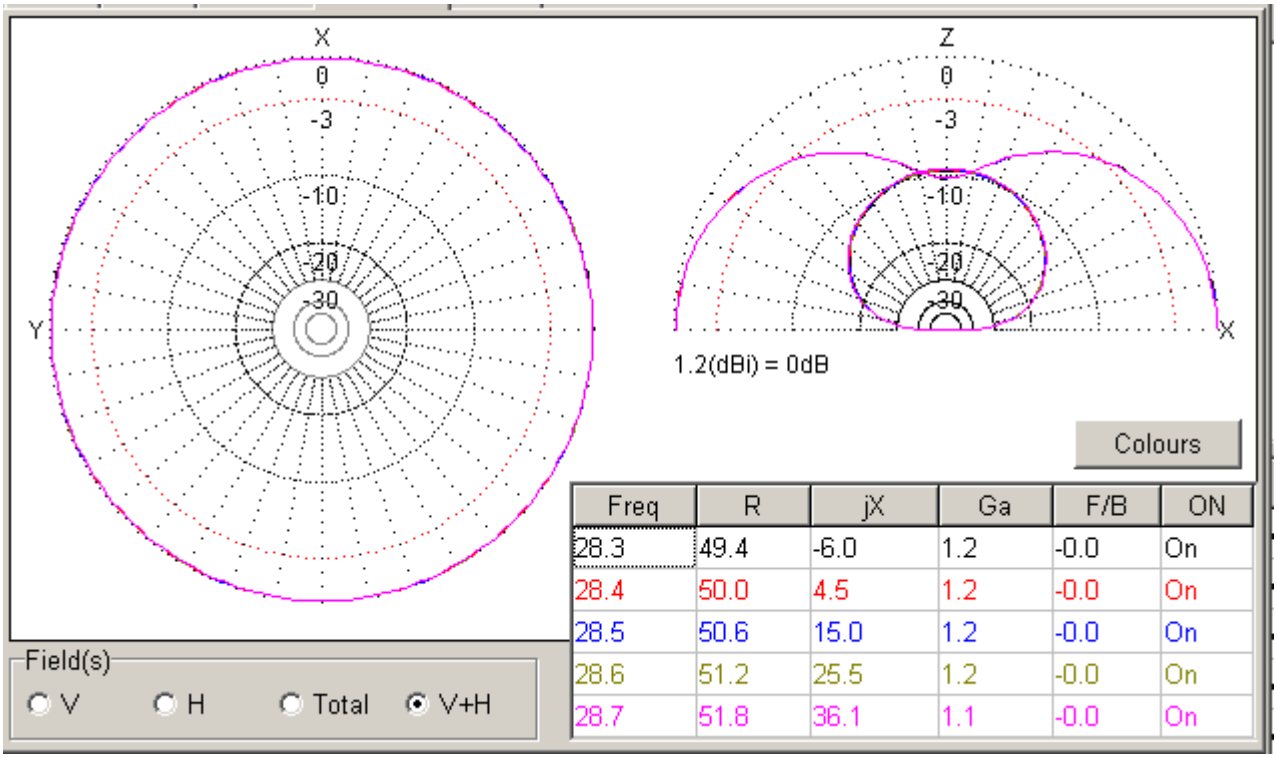


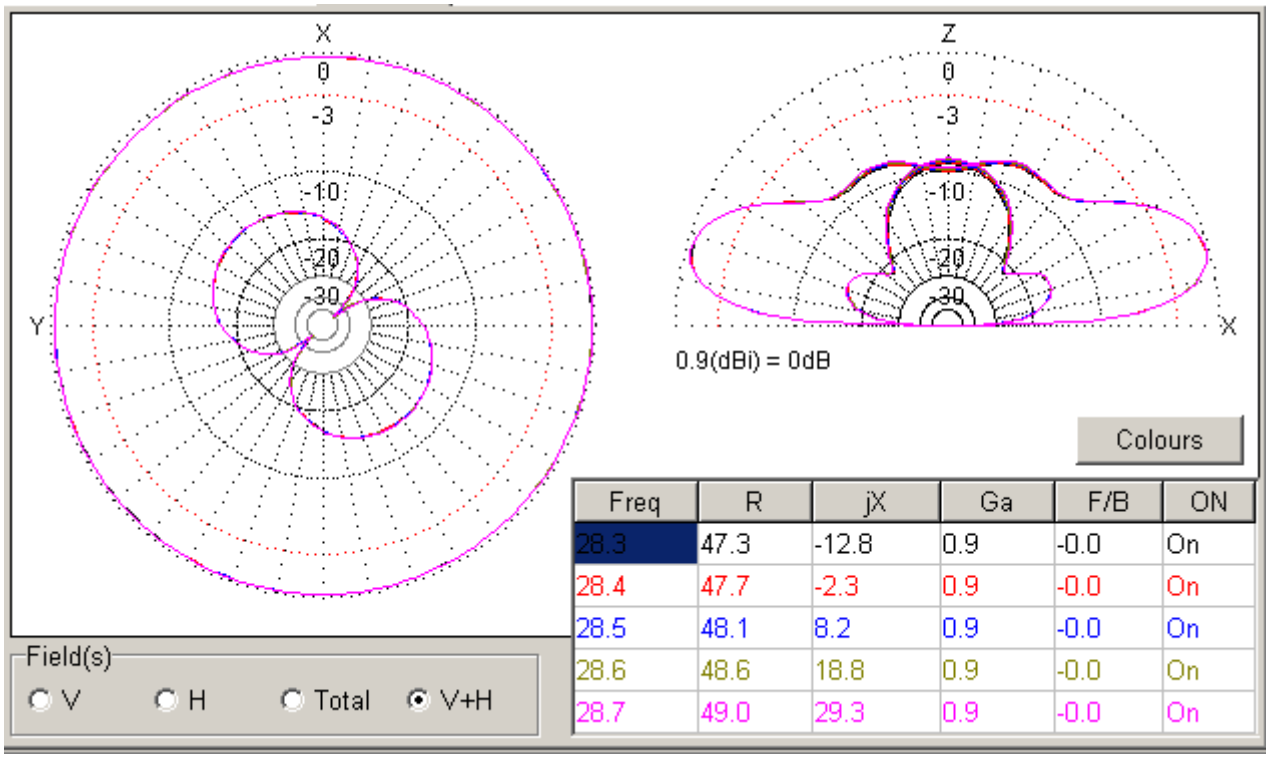
Figure 2 Compact Cage Antenna

Vladislav Shcherbakov, RU3ARJ



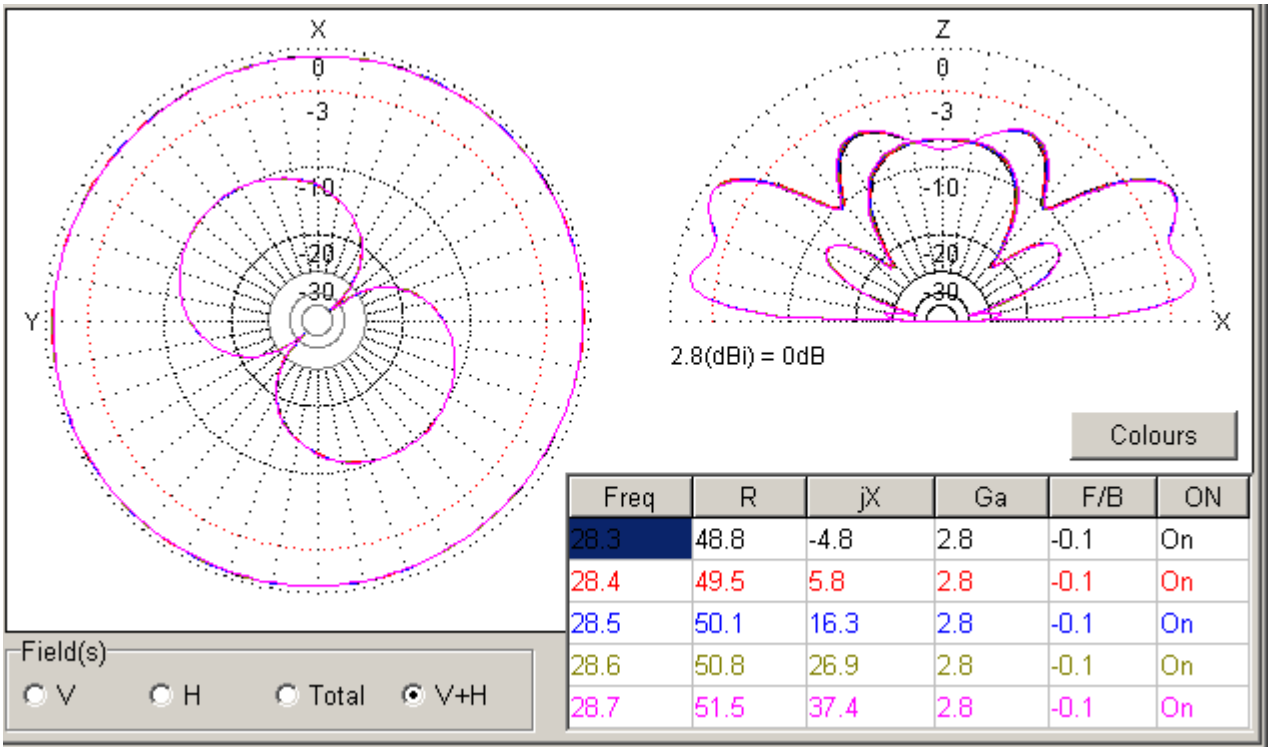
Freq	R	jX	Ga	F/B	ON
28.3	49.4	-6.0	1.2	-0.0	On
28.4	50.0	4.5	1.2	-0.0	On
28.5	50.6	15.0	1.2	-0.0	On
28.6	51.2	25.5	1.2	-0.0	On
28.7	51.8	36.1	1.1	-0.0	On

Figure 3 Free space radiation patterns for Compact Cage Antenna



Freq	R	jX	Ga	F/B	ON
28.3	47.3	-12.8	0.9	-0.0	On
28.4	47.7	-2.3	0.9	-0.0	On
28.5	48.1	8.2	0.9	-0.0	On
28.6	48.6	18.8	0.9	-0.0	On
28.7	49.0	29.3	0.9	-0.0	On

Figure 4 Compact Cage Antenna radiation patterns at 1/3 wavelength height above the ground



Freq	R	jX	Ga	F/B	ON
28.3	48.8	-4.8	2.8	-0.1	On
28.4	49.5	5.8	2.8	-0.1	On
28.5	50.1	16.3	2.8	-0.1	On
28.6	50.8	26.9	2.8	-0.1	On
28.7	51.5	37.4	2.8	-0.1	On

Figure 5 Compact Cage Antenna radiation patterns at 1.0 wavelength height above the ground

All the characteristics of corner fed CCA are almost the same as for usual CCA shown on **Figure 2**. MMANA file for the antenna (named Trihat- quad-1) may be found at MMANA “Antenna Library“ (**References 1**) or loaded by the link below.

The modeling of both these antennas shows that their geometry may be modified for better match to 50-Om feeding line.

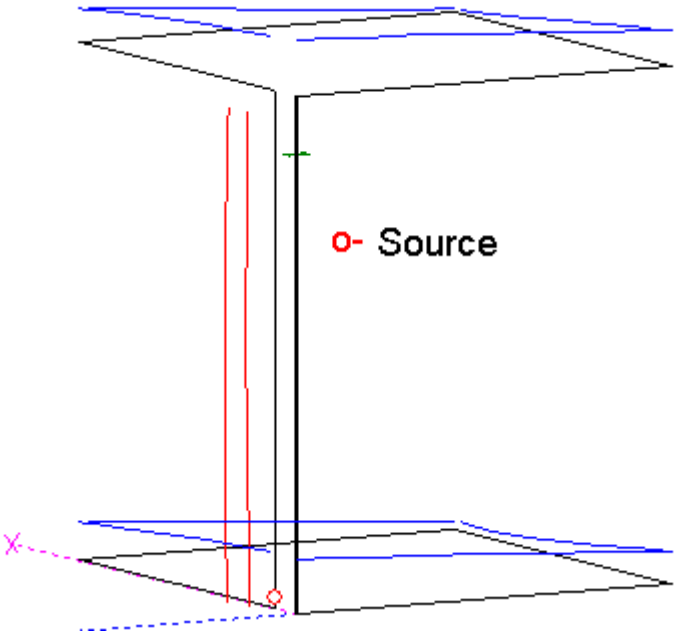


Figure 6 Compact Cage Antenna with corner feeding

It can be reached by "opening" the upper loop a bit (**Figure 7**) or bend the corner of the upper loop by 45-degrees upward (**Figure 8**). MMANA file for the antennas (**Figure 7**- cca_open_corner, **Figure 8**- cca_bended) may be loaded by link below. You may recalculate the dimensions (using function "Scale" at MMANA) for any frequency you need.

Compact Cage Antenna is a symmetric antenna, so, it is required to feed the antenna using a BalUn. Otherwise coaxial cable feeder would affect antenna input impedance and radiation patterns. As a BalUn we use 5-10 ferrite cores on the coax near the feeding point. You may wind 3-6 turns of the coax on a larger ferrite ring as well (near the feeding point).

Here are some building notes: for example, sides of the CCA for the 10-meters are near 1 meter in length. So, the antenna can be made from a copper or aluminum tube 5-10-millimeters in diameter. For lower bands you may use a copper wire 1-3 mm, stretched by some dielectric frame. For UHF-VHF bands the antenna may be made of any bimetallic conductor.

Some advantages of the CCA:

1. Tiny, toy-like size.
2. Bandwidth similar to usual full sized loop.
3. Gain is close to dipole's gain.
4. All-directional radiation pattern in the horizontal plane.
5. Low elevation angle.
6. Low-noise and no electrostatic.
7. Good match to 50-Ohm coaxial.

It could be very interesting to design a phase antenna arrays either with passive or active feeding using several CCA's.

However, I leave this for the readers

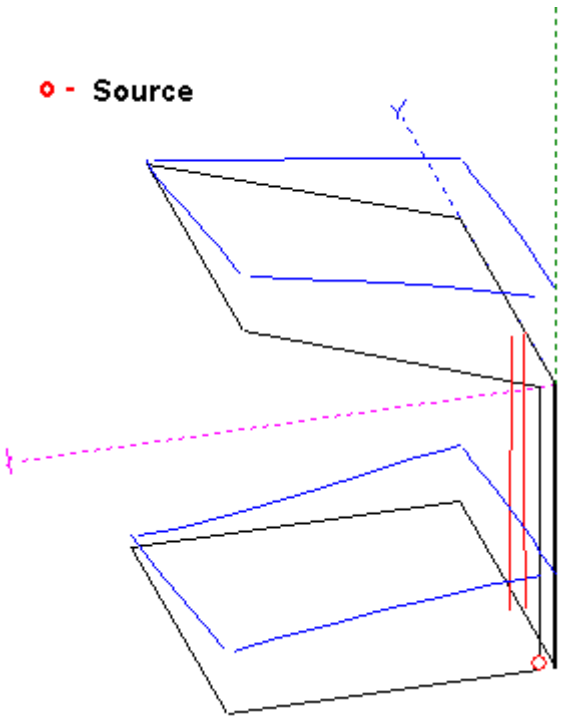


Figure 7 Compact Cage Antenna with "opened" the upper loop

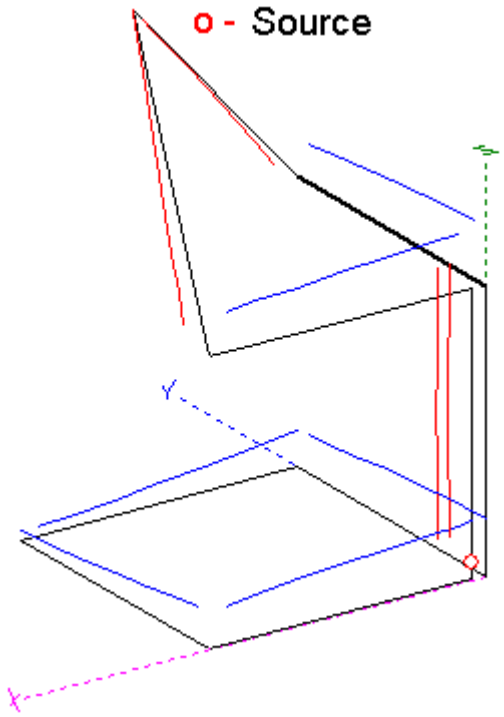


Figure 8 Compact Cage Antenna with a corner bended upward

References: www.dl2kq.de

Files MMANA:

http://www.antentop.org/011/cca_011.htm