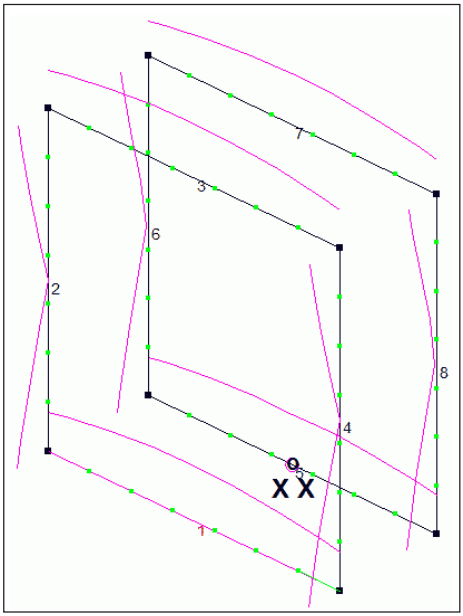
The DK7ZB-Quadlong-Antenna for 50 MHz

Martin Steyer, DK7ZB

The main advantage of a 2-Element-Quad is the great 3-dB-Azimuth-angle. This advantage disappears, if you mount director elements in front of the antenna. In that case the additional gain comes mainly from the reduced azimuth-angle and the antenna parameters become similar to a Yagi antenna. Therefore it makes absolutely no sense to build Quads for one band with more than two elements. Friends of Quads do not like to hear that, but in reality a Yagi antenna with the same number of elements as a multi-element Quad has the same gain and bandwidth and you waste material and wind load with such constructions! Of cause a 3-Element-Quad for shortwave is a good choice, because the spreaders can carry the wires for more than one band and you get an interesting DX-antenna for home brewers.



The electrical principles of the Quadlong

But how can we get the advantages of the 2-element-Quad and can increase the gain? Let us take a look to the classic Quad.

If you prefer a good F/B and greater bandwidth, the gain is 4.7 dBd and F/B is 25-30dB with a high impedance of 110 W. Increasing the gain to 5.7 dBd means very low bandwidth, a bad F/B of 6-8 dB and a lower impedance of 40 W. With a good compromise we do not reach more than 5 dBd gain.

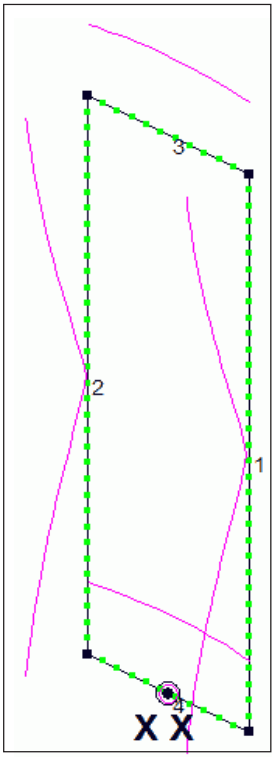
The first step is a simple modification. The original single loop with a circumference of 1 l and a site length of 0.25 l has only a gain of 1.3 dBd and an impedance of 130 W. The Quad element is a stacked system, but the distance between the two parts is to low and the current maxima are to close together. We can increase the gain by changing the Quad to an “Oblong”. The stacking distance will be greater, but the radiating horizontal parts of the loop become smaller. The best compromise between the two influences is a relation of about 0.15 l : 0.375 l.

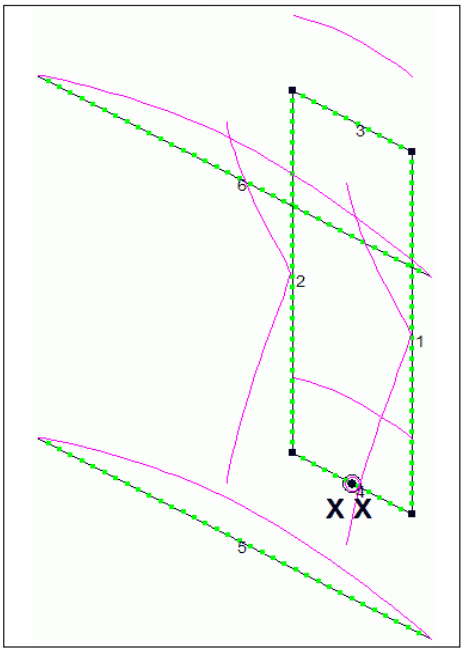
The gain of this loop is now 2.6 dBd and the radiation resistance drops down to 35 W. This is the reason why the elements should not be made of wire with exhibit too many losses.

In a second step we replace the reflector loop by two stretched tubing

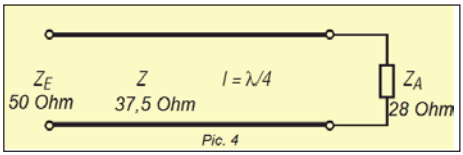
elements. The gain is about 0.2 dB higher than with a reflector loop. The pattern is better than with a loop, too, and the mechanical problems for building the antenna are much easier to solve. So we come to the "DK7ZB-Quadlong".

The picture shows the element currents and the dimensions





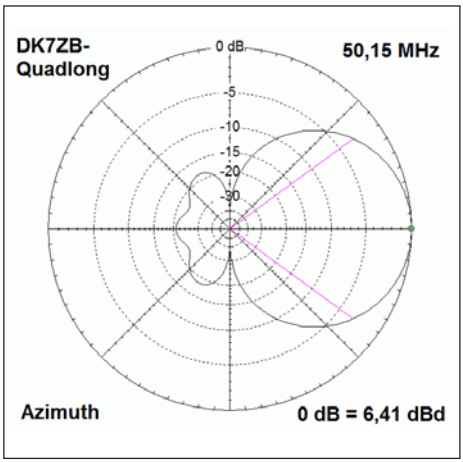
of the new Quad type. The gain is more than 1 dB above the classical Quad and with 6.4 dBd as high as with a 3-Element-Quad, but all other data are better (see ***table 1***) and the construction is much easier. The impedance is now 28 +/- j 0 W and a simple feeding with the "DK7ZB-Impedance-Choke" is possible. We need only 2x 75-W-coax in parallel with an electrical length of l/4.



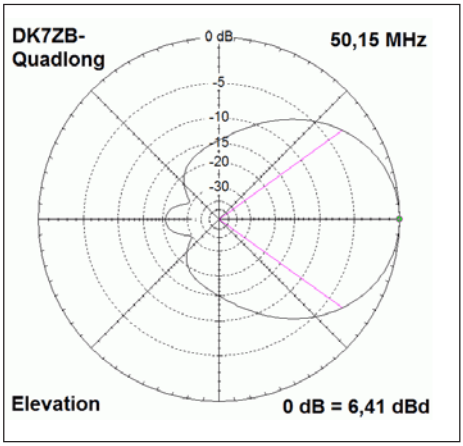
Pic. 4

With a worse F/B a higher gain up to 6.6 dBd is possible, but the chosen dimensions give the best compromise in my eyes.

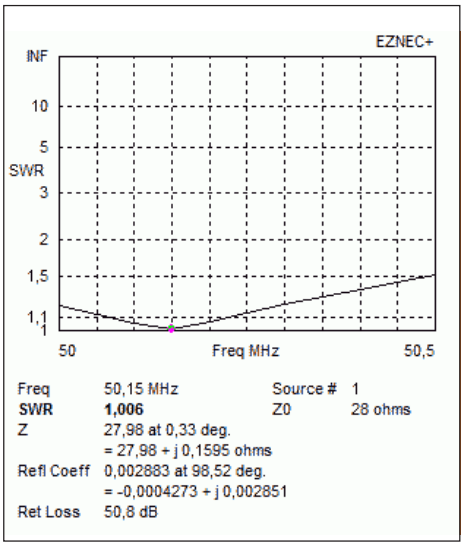
All steps for developing this new aerial were made with EZNEC +5 [1], which is an excellent tool for antenna simulating and constructing. The free space-patterns for azimuth and elevation are shown in ***pic. 1*** and ***pic. 2***, the SWR for 50.0-50.5 MHz in ***pic. 3***.



Pic 1. Azimuth free space radiation pattern.



Pic 2. Elevation free space radiation pattern.

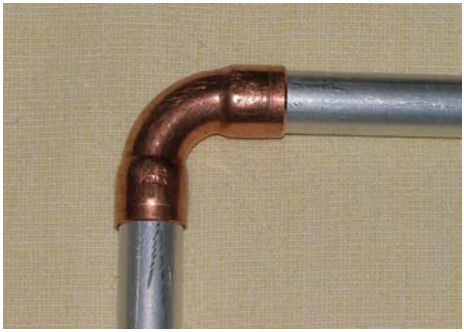


Pic 3. Quadlong SWR pattern.

A practical 50-MHz-Quadlong

A simple solution for building the loop is to use copper-"fittings", which are available in Germany for 12-mm-tubes.

I am sure you find similar material in your country. With these fittings you do not need any tries to bend the tubes in the edges.



Standard copper pipe fittings from your local plumber are used.

A "plumbers delight"-construction is easier. The ends of each part are crushed to a flat piece and can be connected with screws and nuts.

Joining 2 element sections.

In that case only the shorter horizontally mounted tubes are made with 12x1mm-tubes, the vertical parts have 6x1mm.

Two short boom pieces of square-Aluminium with 20x20 mm carry the loop and the reflector elements. Polyamid clamps are mounted between elements and boom, the connection screw to boom has no influence to the element lengths, because they are fixed in the current maxima. A metallic mast running through the antenna between the two

elements does not disturb the data, so you can use a mechanical balanced mounting.

For the dimensions see ***table 2*** on page 34. Other element diameters need other lengths! Thicker element diameters cause a greater circumference, thinner a smaller. I have placed a download for EZNEC-Files on my homepage [2], if you want to calculate other element diameters.

The SWR shows the best return loss at 50,150 MHz and rises up to 1.5 at 50.5 MHz. In practice the bandwidth for a SWR < 1.5 is greater than 1 MHz. If somebody is interested in a 70-MHz-Quadlong, the dimensions are given in ***table 3*** on page 34 for the four metre band.

The 28-W-impedance of the Quadlong is fed with the "DK7ZB-impedance-choke" with 2x 75-W-coax-cable.

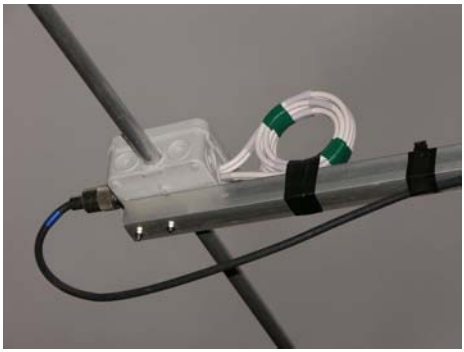


Photo of the Choke.

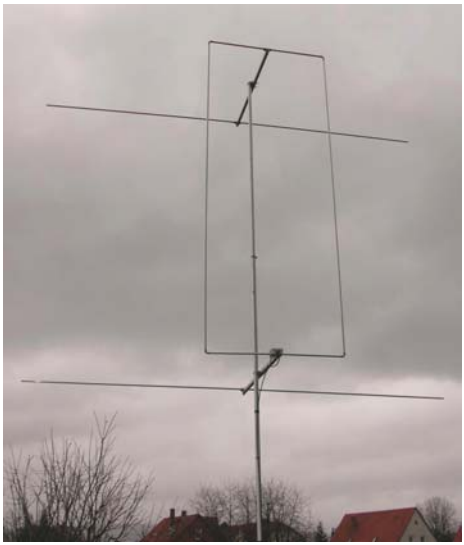
This is the same choke as used at the DK7ZB-high-gain-Yagis [2]. How to construct the radiator-box is seen in the following picture.

In this case a 5-mm-CATV-cable with a V = 0.67 was used (exactly 1.00 m), the choke handles a continuous power

Construction of the Choke.

of 500 Watts RF.

The ready built antenna is seen in the final photo, the SWR at 50.150 MHz is 1.0 with a return loss > 33 dB. A comprehensive test was made with a 2-m-version of the Quadlong, all expected attributes could be verified.



The completed Quadlong.

Table 1: Comparison of some Data for 50MHz-Quad-Antennas

Type	*Gain*	*F/B*	*3dB-angle Az.*	*3dB-angle El.*	*Impedance*
Single Quad	1.3 dBd	0 dB	84.2°	131.8°	130 W
Single Oblong	2.6 dBd	0 dB	87.8°	80.1°	35 W
2-El.-Quad	5.3 dBd	12 dB	70.6°	88.9°	50 W
3-El.-Quad	6.3 dBd	12 dB	65.2°	79.0°	50 W
DK7ZB-Quadlong	6.4 dBd	21 dB	72.4°	71.0°	28 W

Table 2: The dimensions for the 50-MHz and 70MHz-Quadlong

	50MHz-Quadlong		**70MHz-Quadlong**
Reflector length	3000 mm (12 mm)	2992 mm (12 mm)	2126 mm (12 mm)
Distance D (Ref-Loop)	855 mm	855 mm	620 mm
A (hor)	880 mm (12 mm)	890 mm (12 mm)	644 mm (12 mm)
B (ver)	2280 mm (12 mm)	2230 mm (6 mm)	1624 mm (12 mm)

References:

[1] Lewallen, R. (W7EL): Program EZNEC+, V.5.0.23, Info at http://www.eznec.com

[2] Homepage DK7ZB, http://www.mydarc.de/dk7zb

[3] e-mail: dk7zb@darc.de

The New Antenna for the CN8MC Beacon

The UKSMG recently sponsored a new antenna for the CN8MC beacon. We are very grateful to Said, CN8LI for installing the antenna and getting this valuable beacon back on the air again. The beacon runs 10 watts on 50.027 MHz.