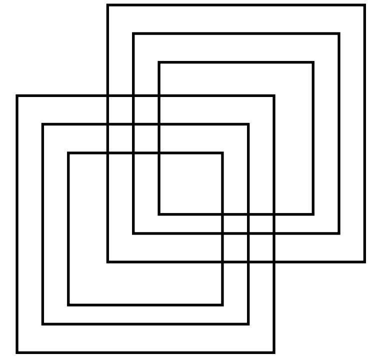


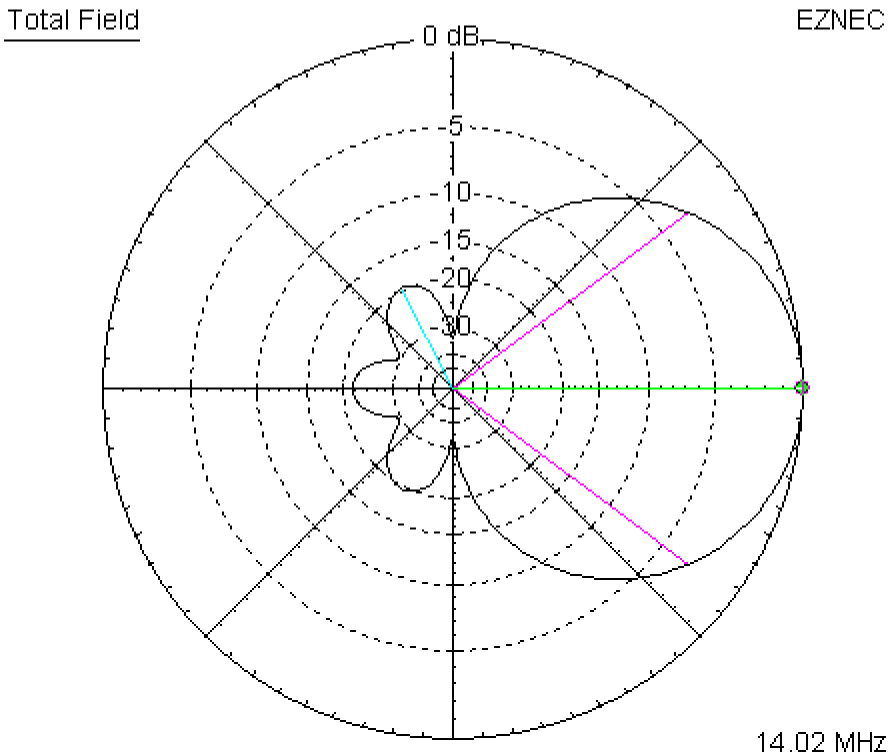
3-band Quad
optimized for CW operators

The concept of multi band Quad antenna is old. My interest was to calculate good dimensions.

I used Eznec 5 modeling software, which is quite reliable in this kind of antenna structures. I have not build the antenna myself. If you do so please let me know about your results.

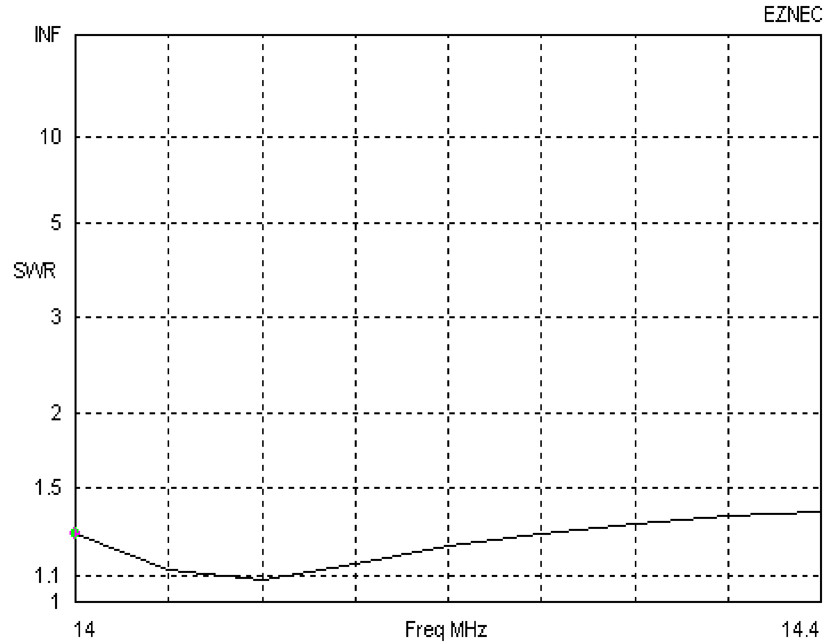
Pekka Ketonen

Performance on 20m CW



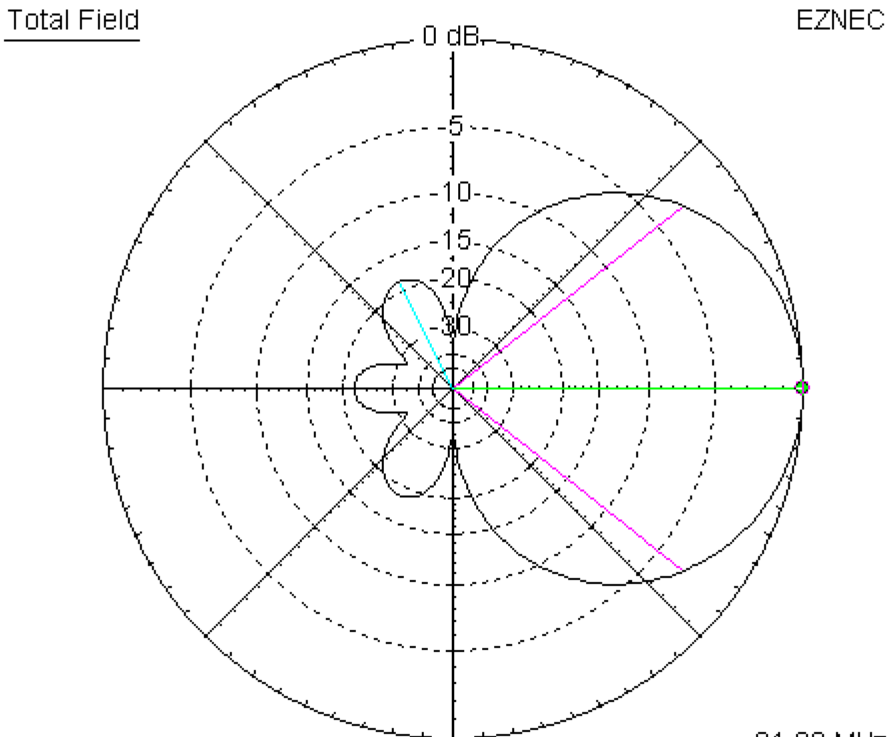
Azimuth Plot		Cursor Az	0.0 deg.
Elevation Angle	0.0 deg.	Gain	7.35 dBi
Outer Ring	7.35 dBi		0.0 dBmax

Slice Max Gain	7.35 dBi @ Az Angle = 0.0 deg.
Front/Back	21.45 dB
Beamwidth	73.2 deg.; -3dB @ 323.4, 36.6 deg.
Sidelobe Gain	-12.13 dBi @ Az Angle = 117.0 deg.
Front/Sidelobe	19.48 dB



Freq	14 MHz	Source #	1
SWR	**1.28**	Z0	50 ohms
Z	63.13 at 3.96 deg.		
	= 62.98 + j 4.36 ohms		
Refl Coeff	0.1211 at 16.36 deg.		
	= 0.1162 + j 0.03411		
Ret Loss	18.3 dB		

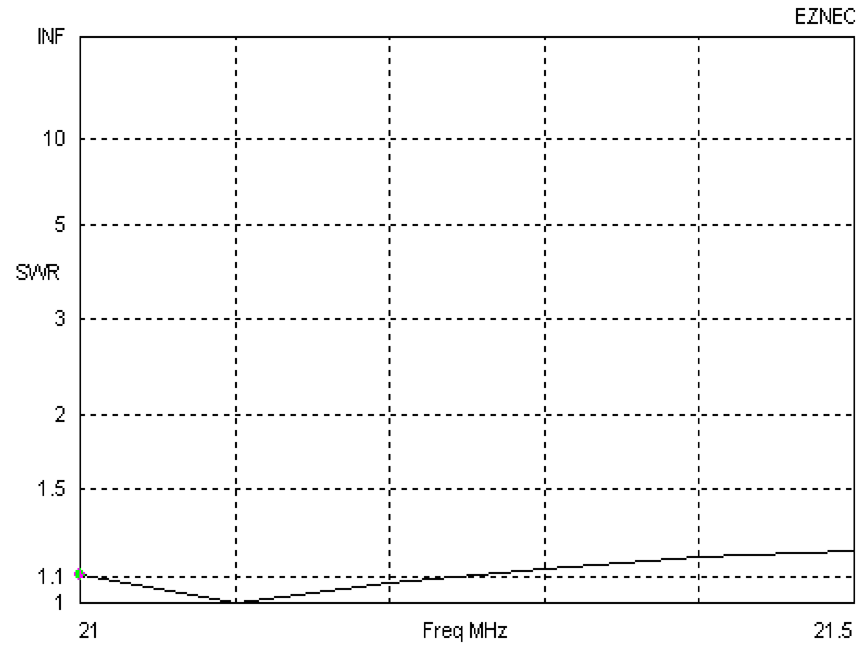
Performance on 15m CW



Azimuth Plot
Elevation Angle 0.0 deg.
Outer Ring 7.2 dBi

Cursor Az 0.0 deg.
Gain 7.2 dBi
0.0 dBmax

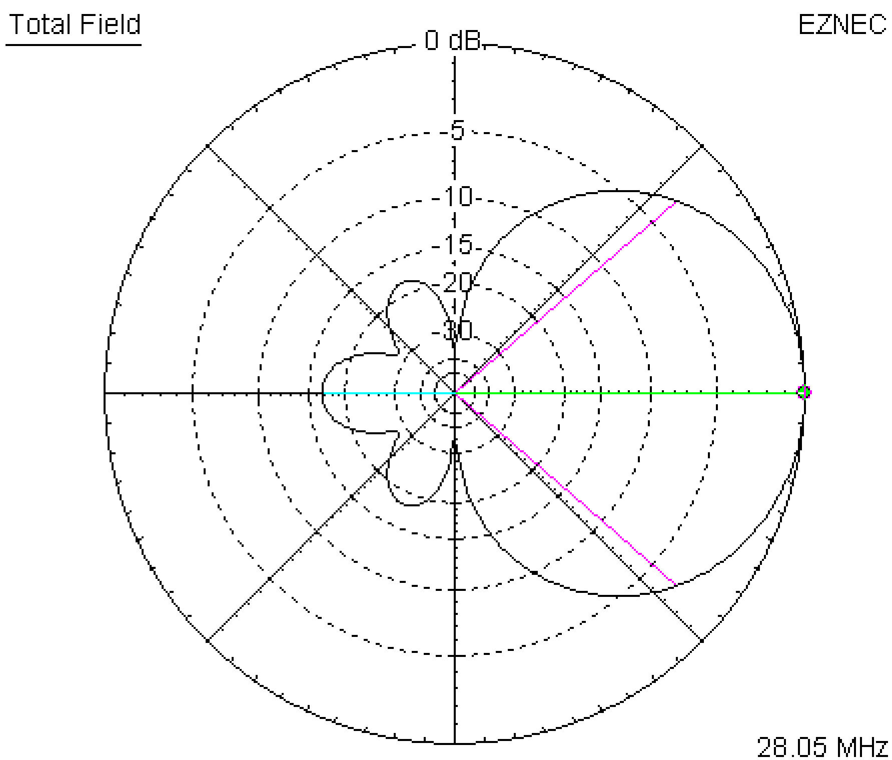
Slice Max Gain 7.2 dBi @ Az Angle = 0.0 deg.
Front/Back 21.67 dB
Beamwidth 76.4 deg.; -3dB @ 321.8, 38.2 deg.
Sidelobe Gain -11.27 dBi @ Az Angle = 117.0 deg.
Front/Sidelobe 18.46 dB

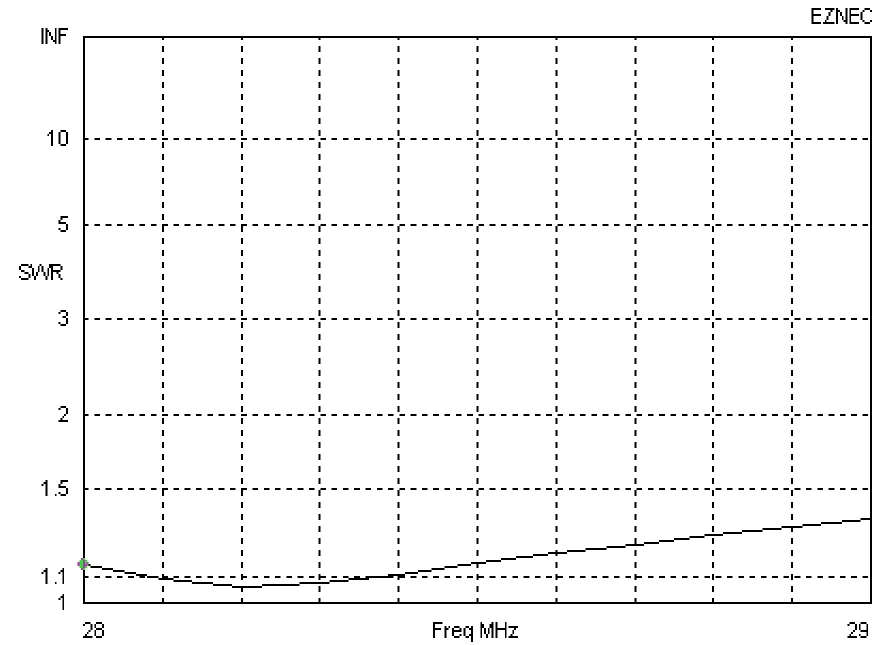


Freq 21 MHz
SWR **1.1**
Z 53.97 at 3.5 deg.
= 53.87 + j 3.299 ohms
Refl Coeff 0.0489 at 38.66 deg.
= 0.03819 + j 0.03055
Ret Loss 26.2 dB

Source # 1
Z0 50 ohms

Performance on 10m CW





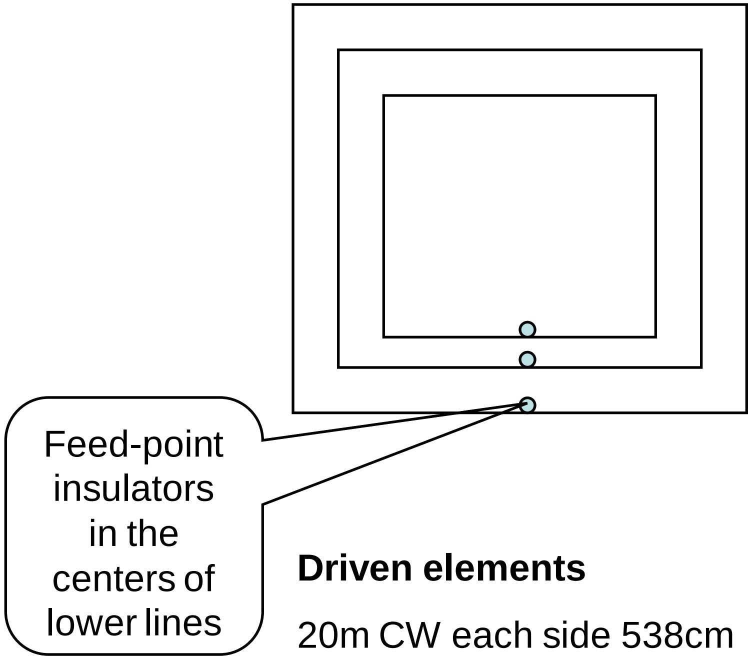
Azimuth Plot	
Elevation Angle	0.0 deg.
Outer Ring	6.98 dBi
Slice Max Gain	6.98 dBi @ Az Angle = 0.0 deg.
Front/Back	16.63 dB
Beamwidth	81.4 deg.; -3dB @ 319.3, 40.7 deg.
Sidelobe Gain	-9.65 dBi @ Az Angle = 180.0 deg.
Front/Sidelobe	16.63 dB

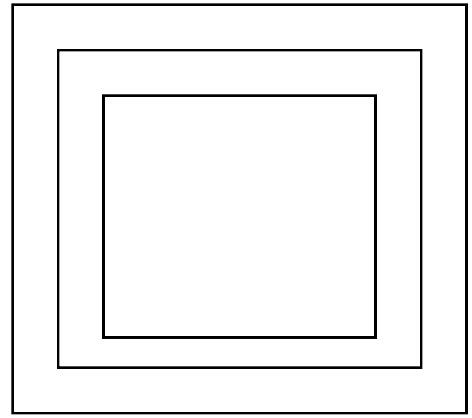
Cursor Az	0.0 deg.
Gain	6.98 dBi
	0.0 dBmax

Freq	28 MHz
SWR	**1.15**
Z	50.28 at 7.81 deg.
	= 49.82 + j 6.83 ohms
Refl Coeff	0.06828 at 87.61 deg.
	= 0.002851 + j 0.06823
Ret Loss	23.3 dB

Source #	1
Z0	50 ohms

Element dimensions





Driven elements

20m CW each side 538cm

15m CW each side 360cm

10m CW each side 266cm

Wires dia 2mm Cu

Reflector elements

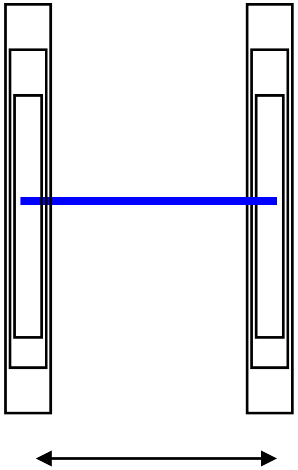
20m CW each side 560cm

15m CW each side 376cm

10m CW each side 288cm

Wires dia 2mm Cu

Element spacing



300cm

Driven element to reflector spacing on all bands

Feeds

- Natural feed-point impedances are
  - 20m CW 100ohm
  - 15m CW 120ohm
  - 10m CW 160ohm

- Matching down to 50 ohm with higher impedance cables
  - cable lengths electrical, to get mechanical length multiply by velocity factor
  - 20m: from feed-point 530cm 75ohm cable, thereafter 50ohm cable
  - 15m: from feed-point 350cm 80ohm cable, thereafter 50 ohm cable (75ohm cable is ok)
  - 10m: from feed-point 260cm 100ohm cable, thereafter 50ohm cable.
    - 100ohm cable can be made by connecting two 50ohm cables in series: outer conductors together in both ends, signal into two center conductors.
  - Current baluns shall be installed next to feed-points. 2-4 ferrite tubes on the cable do the job.

Influence of unused cables

- Cables connected to the feeds of unused bands may cause some worsening of SWR on the band used. In order to avoid the influence of unused feed-lines, a short circuit should exist at the unused feed-points. The electrical short circuit shall exist on the operating frequency. Such a short circuit could be provided remotely via coax cable. As we have 3 different bands, playing with cable lengths is difficult however.
- The best way is to have relays across each feed-point. The relay makes short circuit, when the feed (band) is not in use. Only one relay is open at a time. Do not burn your power amplifier!
- Playing with short circuits or open cable ends at different distances from the feed-points would mean
  - Open circuit ¼ wavelength (of the operating band) from the feed-point of unused bands.
  - A short circuit n x ½ electrical wavelength (of the operating band) (n=1,2,3,..) from the feed-points of unused bands