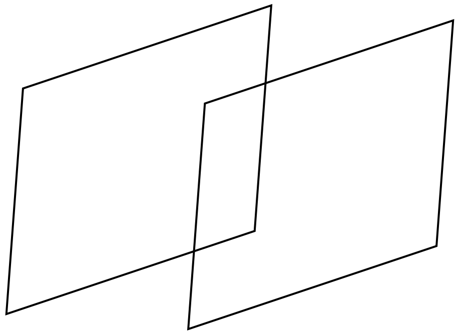


# Quad improved

This is an analysis about possibility to apply Opposite Voltage Feed system to 2-element Quad and study what advantage it would provide.

Pekka Ketonen

# What is Opposite Voltage Feed?

OVF is a method to feed 2-element antennas. It makes possible to adjust current amplitudes and phases so that good radiation pattern can be achieved. The main advantage is insensitivity of radiation pattern to frequency change. The concept is that equal amplitude but opposite phase voltages are brought to the element feedpoints. By selecting proper detuning of the elements and taking into account their mutual impedance, it is possible to reach equal currents and wanted phase difference of the currents. When frequency is changed, both current phases move to the same direction and their difference remains almost constant, making the radiation pattern wideband.

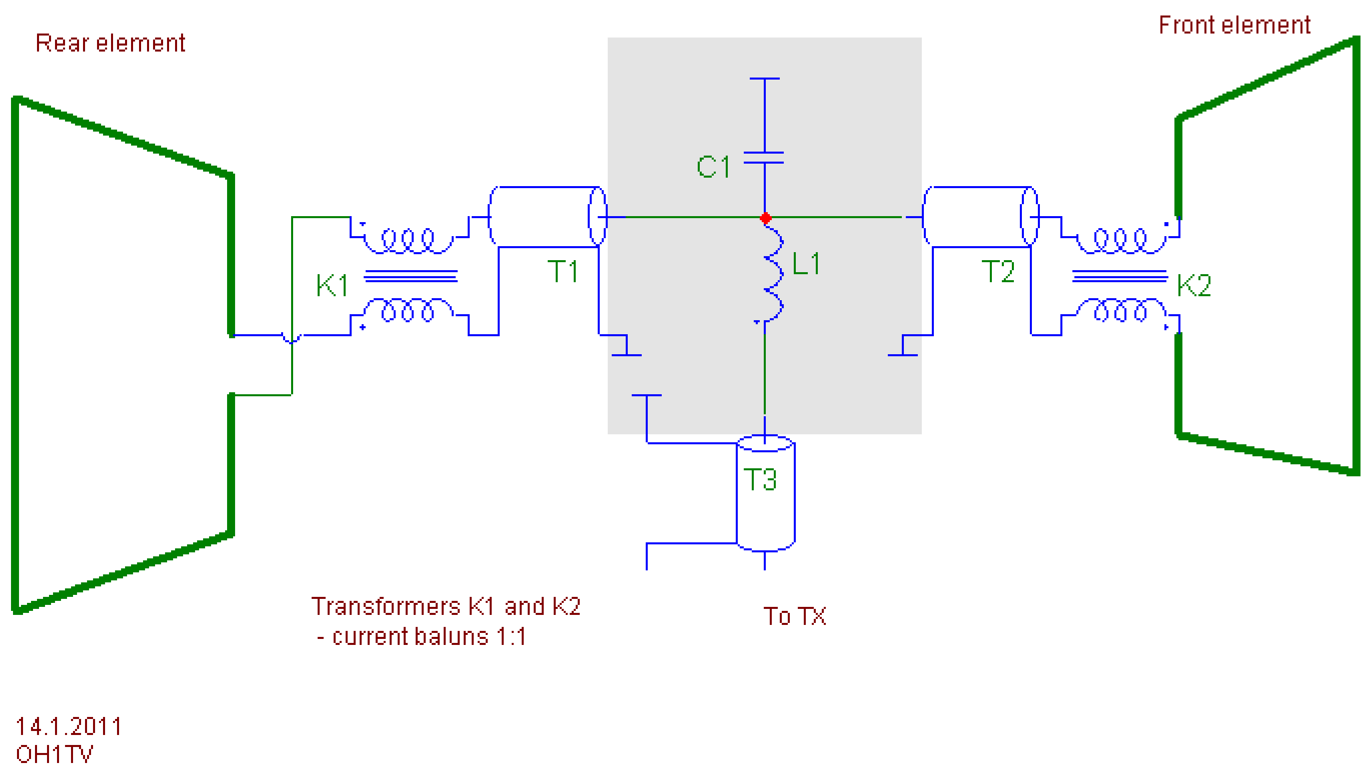
Opposite phase normally is generated with half wavelength cable. It can be achieved also with cable polarity inversion and two cables, each half wavelength long.

An approximation of phase reversal can be made using very short equal length cables and cable polarity inversion. This method is not perfectly accurate but in most cases adequate.

In the following analysis the short cable method is used.

# Concept of Opposite Voltage fed 2-el Quad

top view



# Traditional Quad on 15m

file: 2q21

**Traditional**

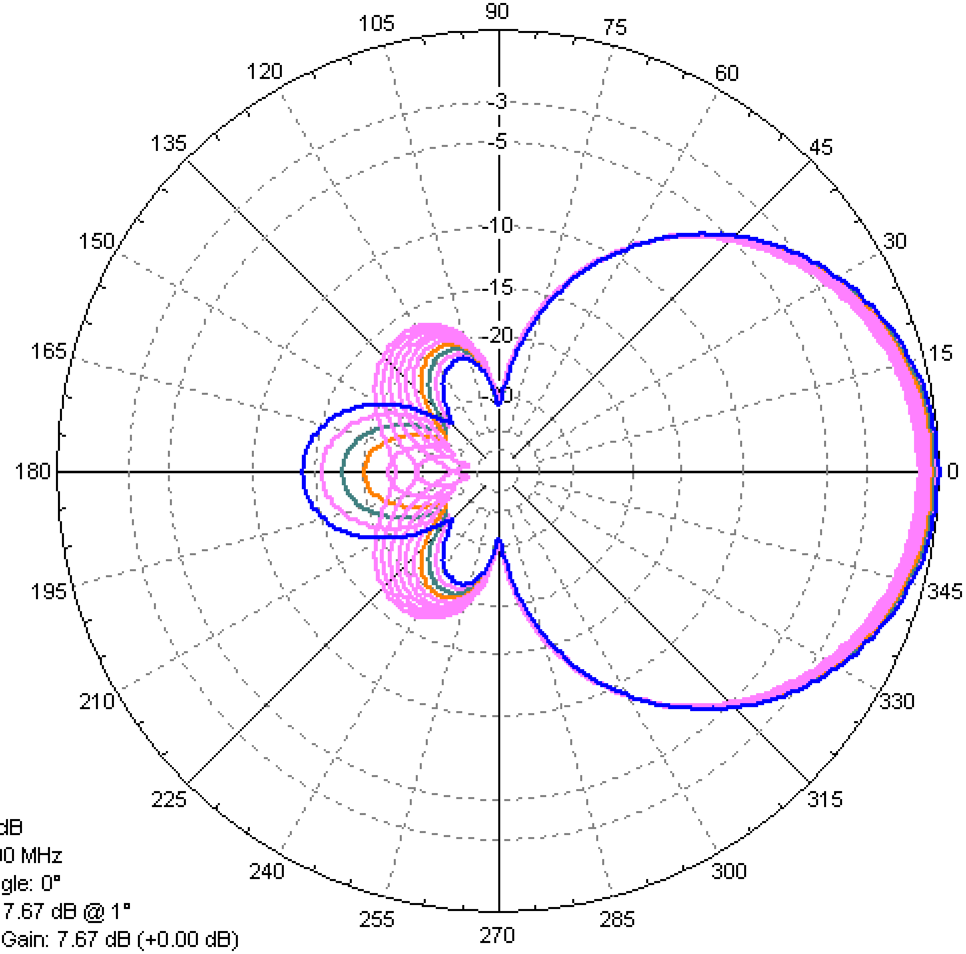
Spacing 230cm

Driven 358x358cm

Reflector 376x376cm

Wire 2mm cu

Sweep is 21.00-21.45MHz in 50kHz steps




Main Lobe:
BW: 72.75°
F/B: 13.77 dB
Freq: 21.000 MHz
Takeoff Angle: 0°
Lobe Gain: 7.67 dB @ 1°
Outer Ring Gain: 7.67 dB (+0.00 dB)

# OVF-Quad

2q21-ovf, same dimensions as in traditional Quad before

**2q21-ovf**

Spacing 230cm

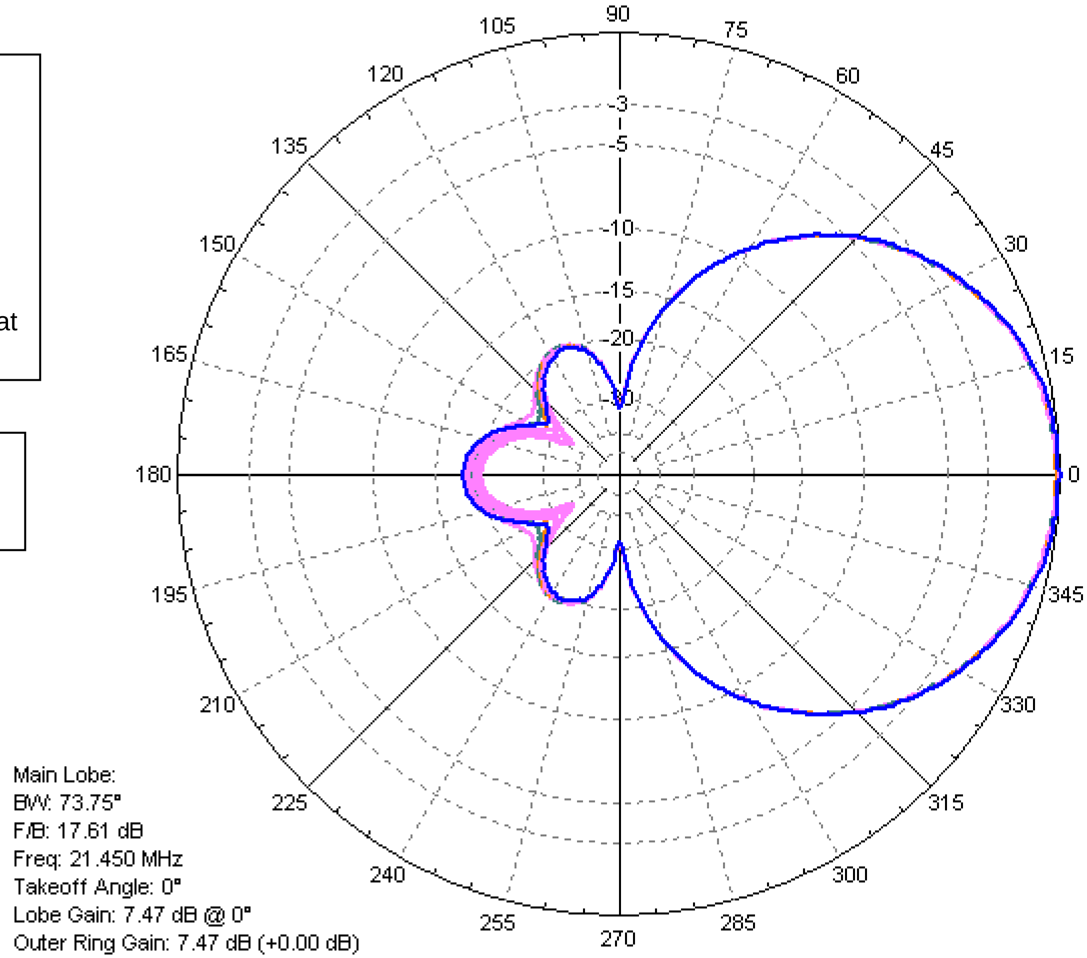
Driven 358x358cm

Reflector 376x376cm

Wire 2mm cu

Fine tuning with coils at the feedpoints

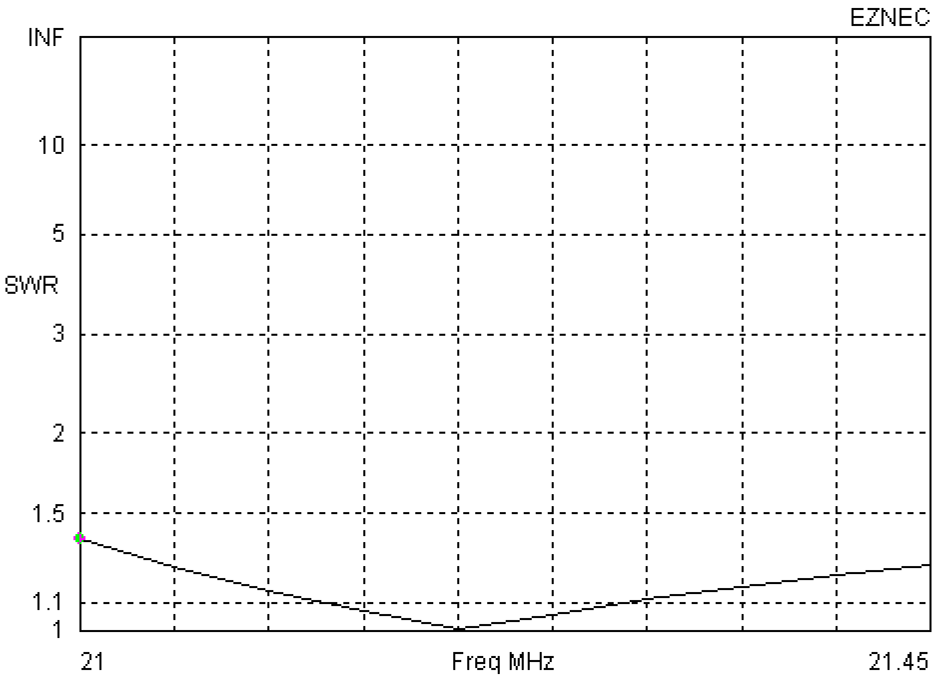
Sweep is 21.00-21.45MHz in 50kHz steps



# Traditional Quad

L-match used

Sweep is 21.00-21.45MHz in 50kHz steps



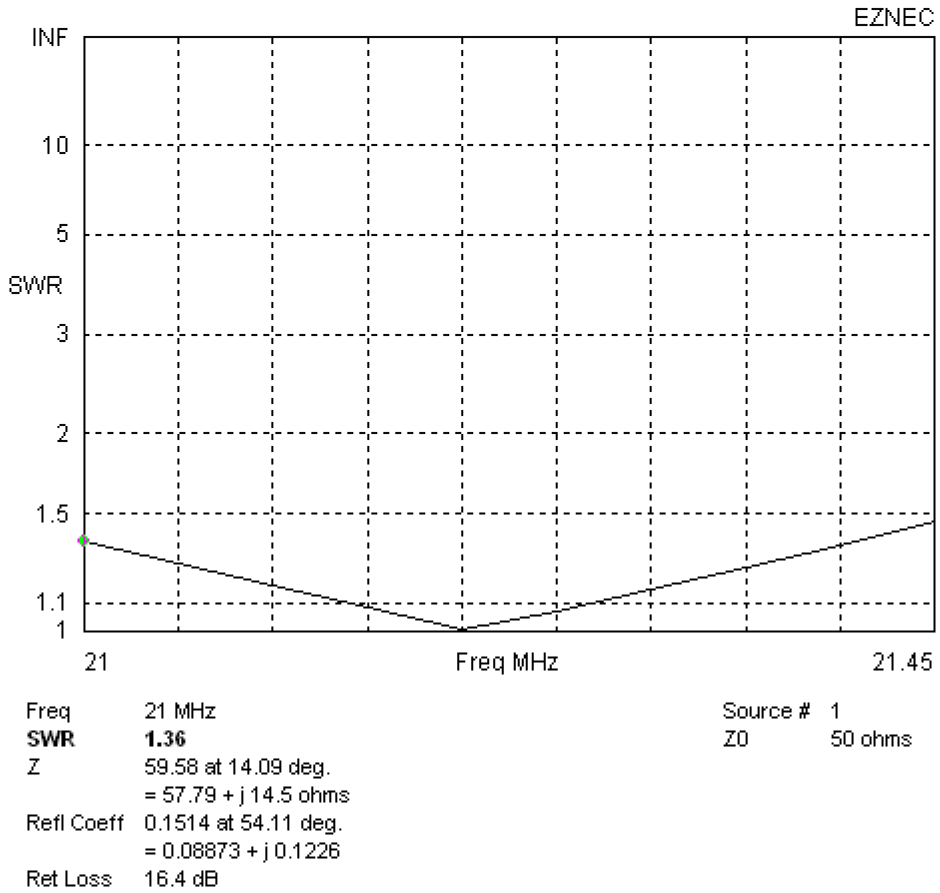

| | | | |
|---|---|---|---|
| Freq | 21 MHz | Source # | 1 |
| **SWR** | **1.37** | Z0 | 50 ohms |
| Z | 43.07 at 15.4 deg. | | |
| | = 41.52 + j 11.44 ohms | | |
| Refl Coeff | 0.1543 at 119.42 deg. | | |
| | = -0.07582 + j 0.1344 | | |
| Ret Loss | 16.2 dB | | |

# OVF-Quad

2q21-ovf, same dimensions as in traditional Quad before

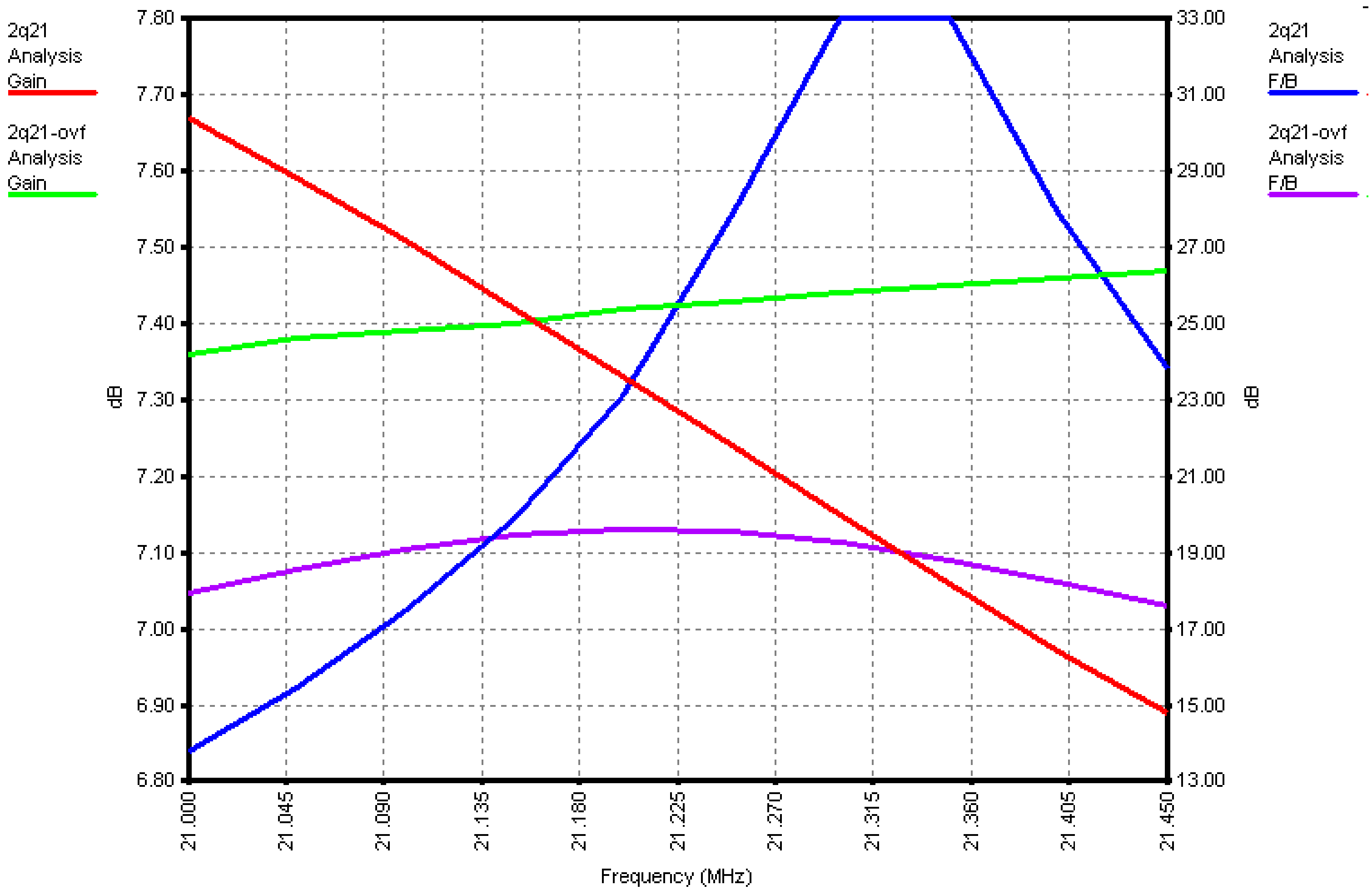
L-match used

Sweep is 21.00-21.45MHz in 50kHz steps



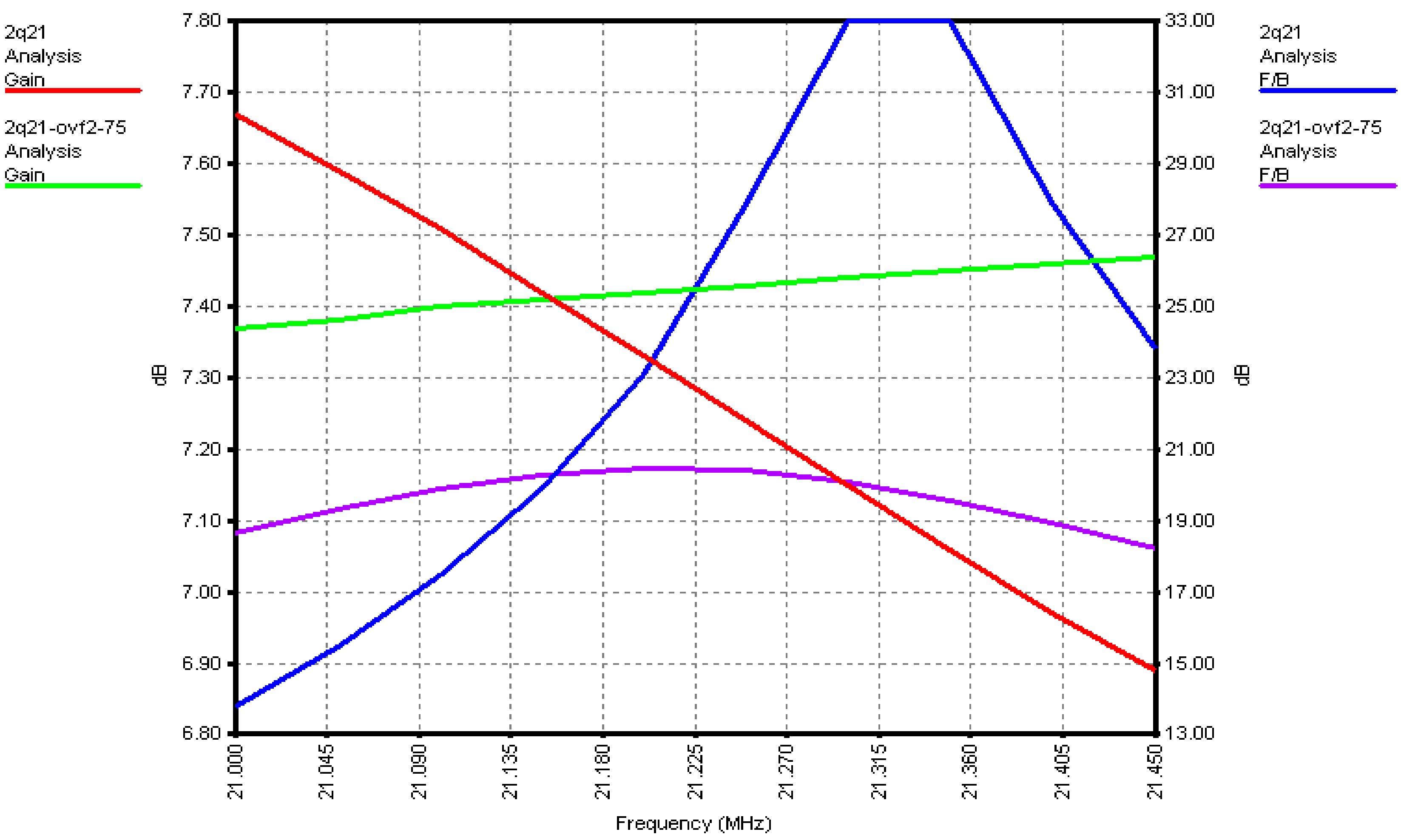
# Gain and front-to-back

## Comparison of traditional and OVF-Quad (same wire dimensions)



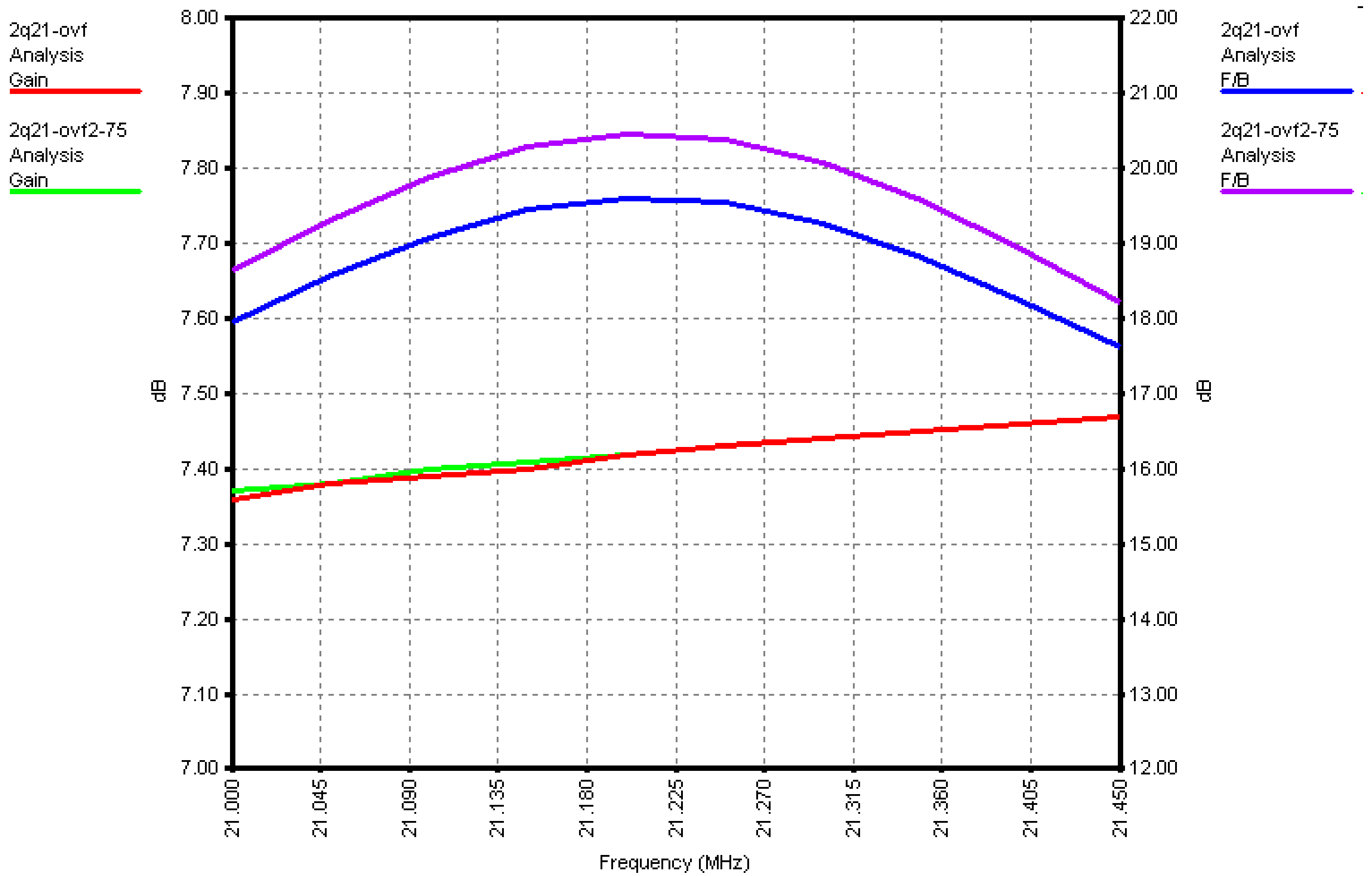
# Gain and front-to-back

Comparison of traditional and OVF2-75 -Quad



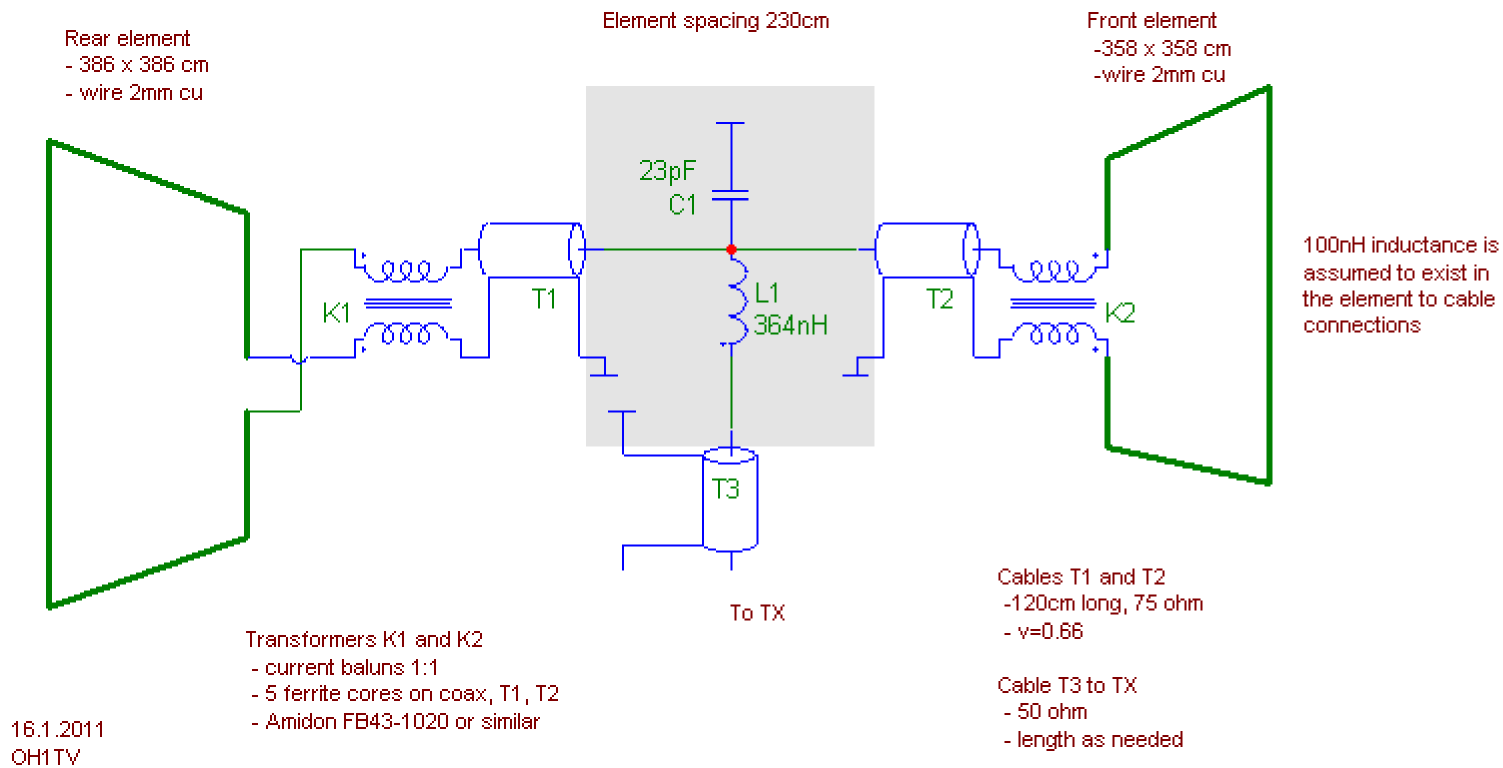
# Gain and front-to-back of OVF-Quads, 75Ω lines

## Comparison of different loop size Quads



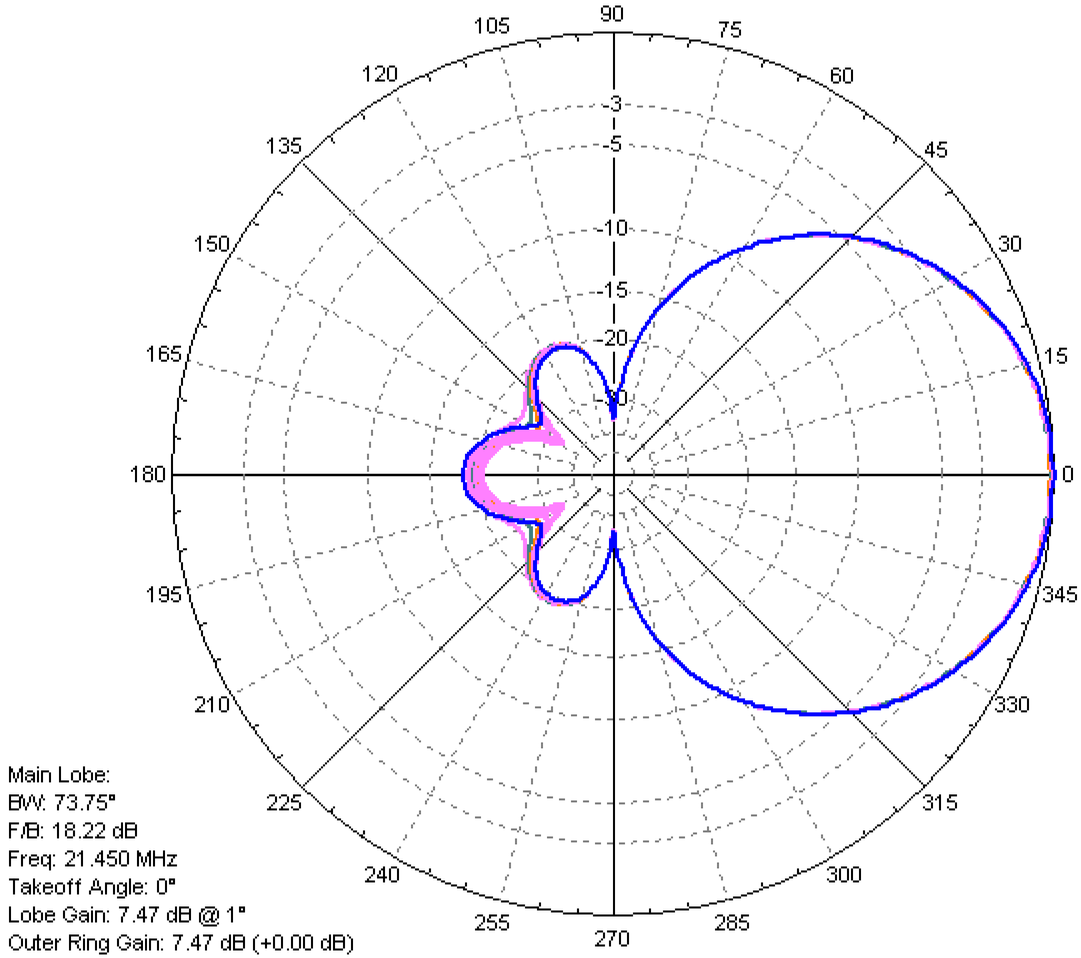
# Optimized OVF-Quad

Eznec: 2q21-ovf2-75



# Optimized OVF-Quad

Eznec: 2q21-ovf2-75




**2q21-ovf2-75**

Spacing 230cm

Driven 358x258cm

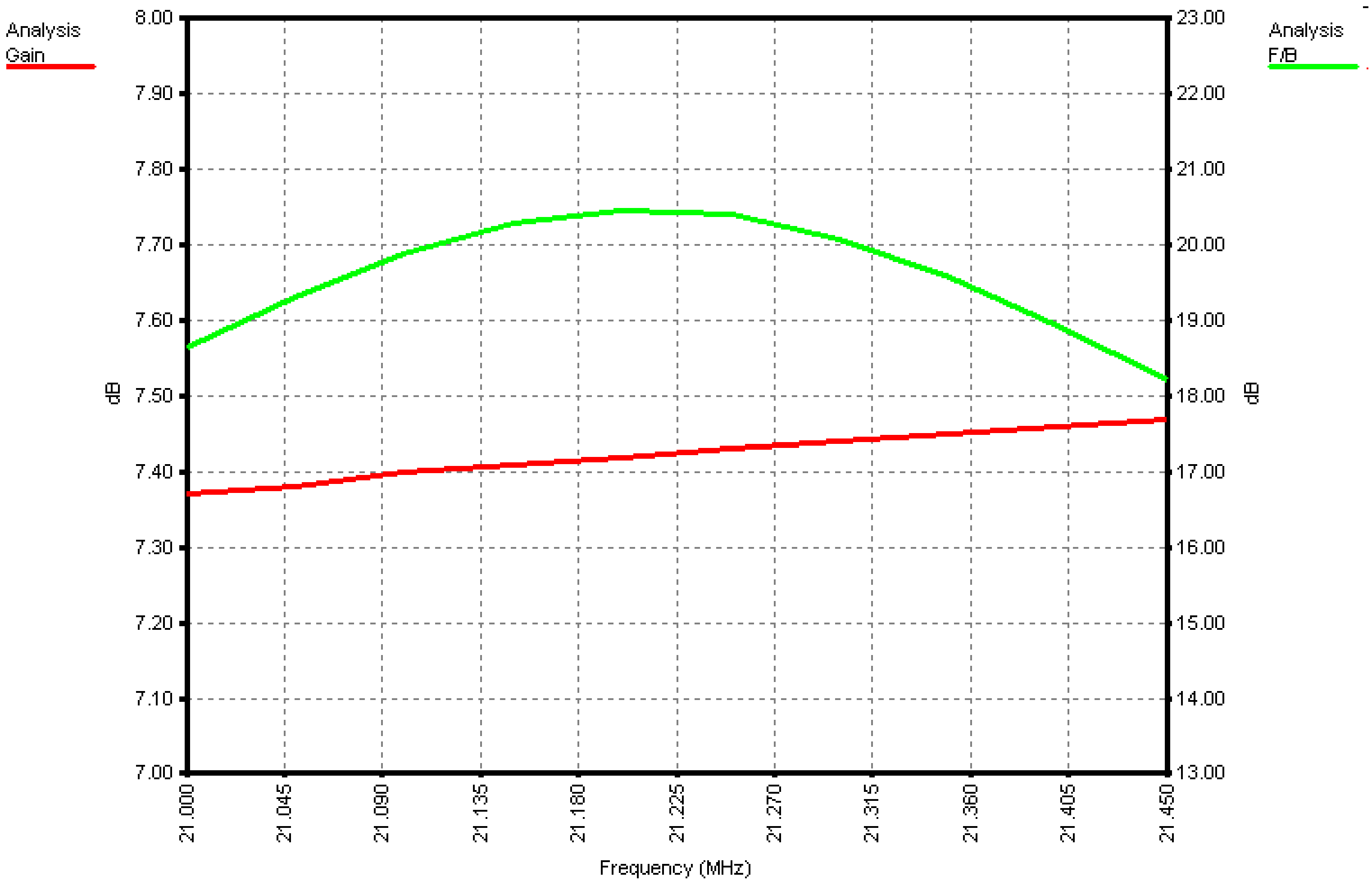
Reflector 386x386cm

Wire 2mm cu

+ 100nH coils at both feedpoints

# Optimized OVF-Quad

Eznec: 2q21-ovf2-75

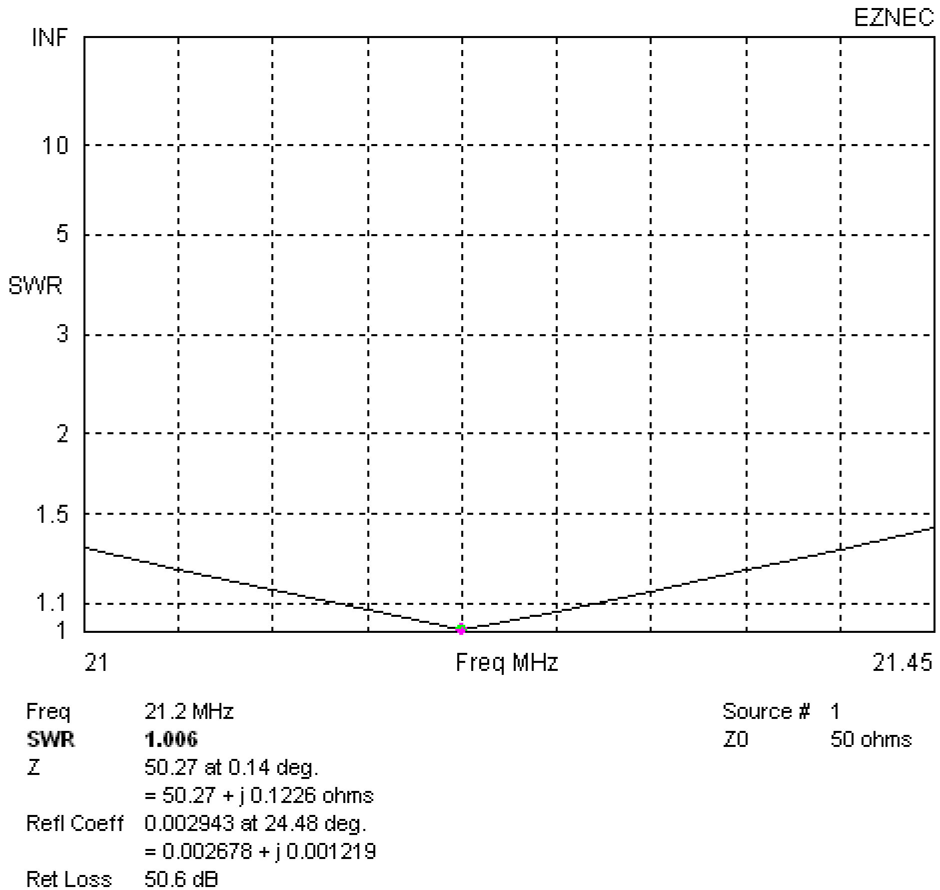


# Optimized OVF-Quad

2q21-ovf2-75

L-match used

Sweep is 21.00-21.45MHz in 50kHz steps



# Conclusions

- Opposite voltage feed makes 2-el Quad less frequency dependent
  - Gain variation over 21MHz band is only 0.1dB
    - 0.8dB in traditional parasitic Quad
  - F/B variation is also smaller, from 18.2 to 20.5dB, window being 2.3dB
    - 14-38dB in traditional parasitic Quad
  - SWR is slightly higher than in traditional Quad at upper end of band
    - but SWR is still less than 1.5
- 75 ohm coax cable is good for feeding the elements.
  - cables to the elements shall have equal lengths
    - 2x120cm cables v=0.66 were used as element spacing was 230cm
- L-match can be used to match the antenna into 50ohm cable
  - T-connection and matching unit can be integrated
- Complexity of Quad is only slightly increased in comparison to traditional Quad

# OVF-Quad

## 14.00-14.35MHz in 50kHz steps

**2q14-ovf2**

Spacing 345cm

Driven 538x538cm

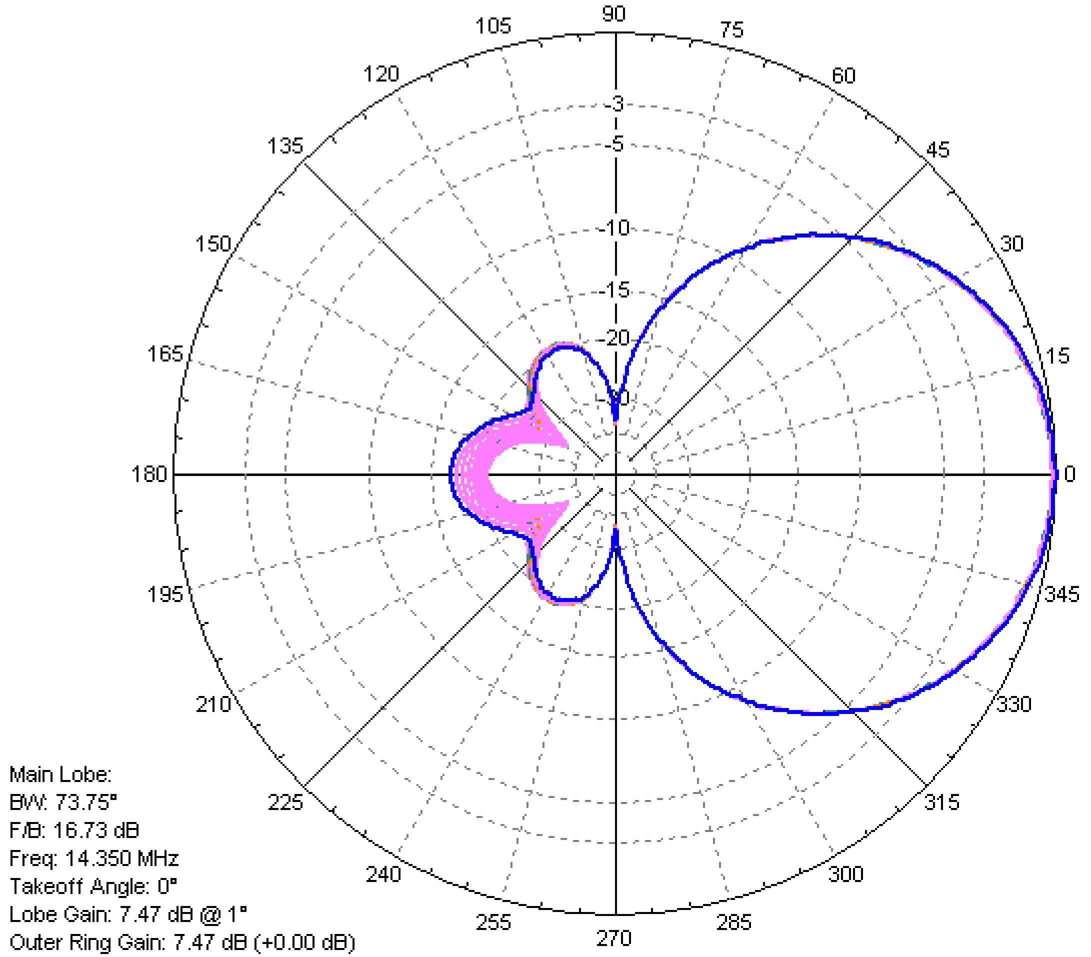
Reflector 578x578cm

Wire 2mm cu

+ 100nH coils at both feedpoints

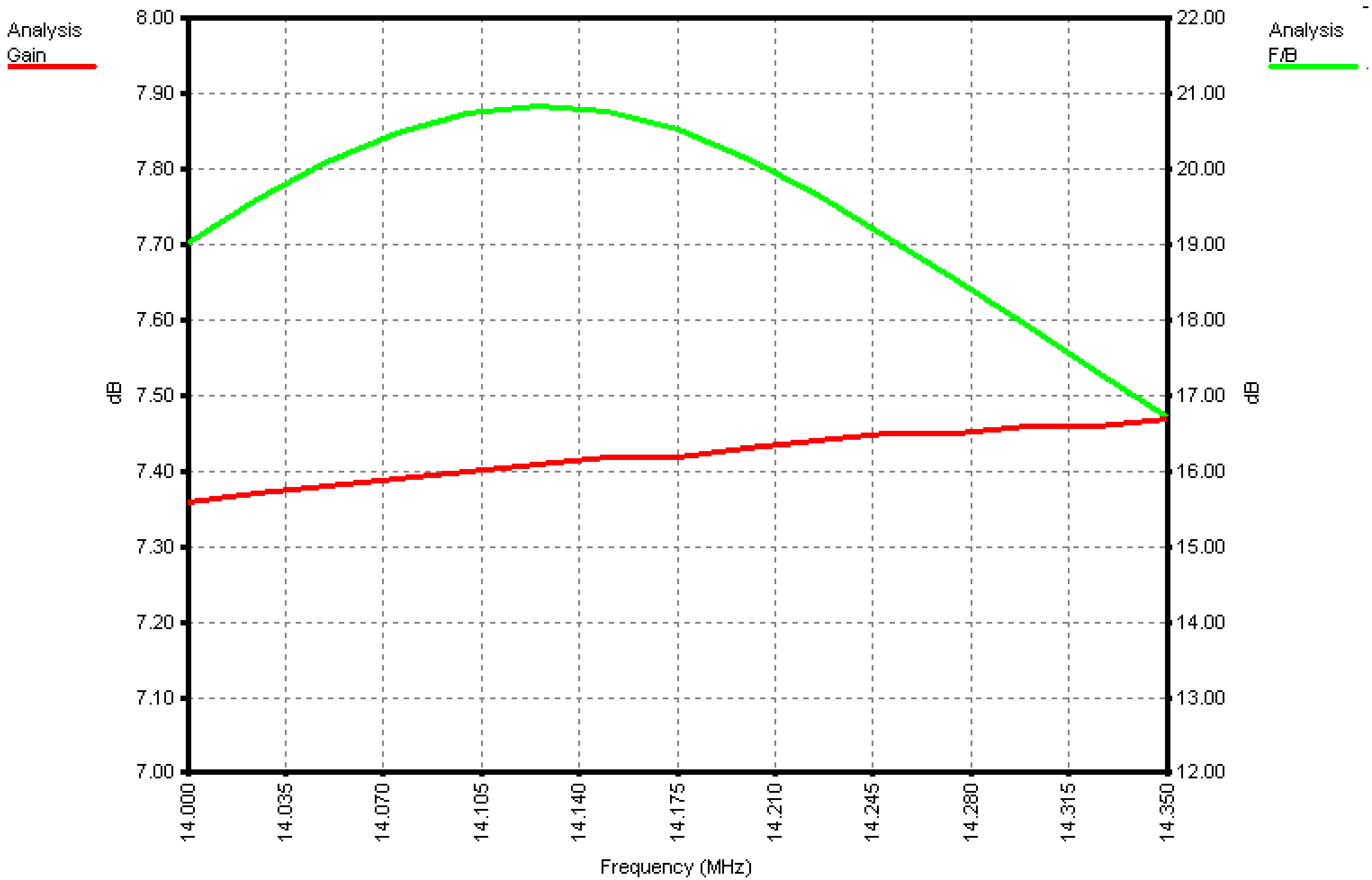
Feed cables 2x180cm 75ohm v=0.66

L-match 29pF, 575nH



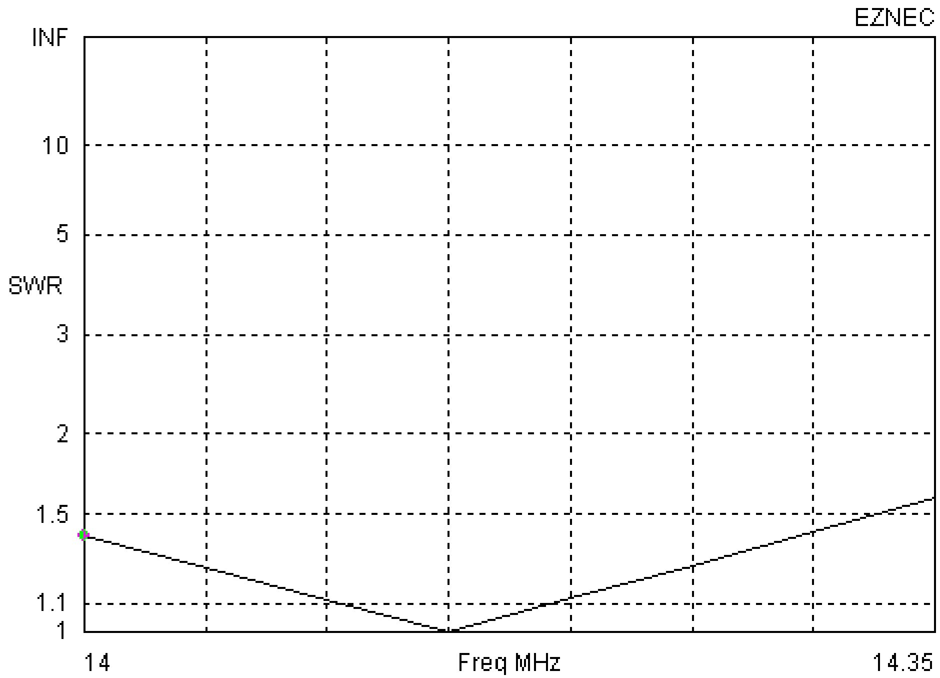
# OVF-Quad

## 14.00-14.35MHz in 50kHz steps



# OVF-Quad

## 14.00-14.35MHz in 50kHz steps




| | | | |
|---|---|---|---|
| Freq | 14 MHz | Source # | 1 |
| **SWR** | **1.38** | Z0 | 50 ohms |
| Z | 60.4 at 14.8 deg. | | |
| | = 58.39 + j 15.43 ohms | | |
| Refl Coeff | 0.1604 at 53.35 deg. | | |
| | = 0.09574 + j 0.1287 | | |
| Ret Loss | 15.9 dB | | |