This article describes one possible BOG implementation for the 1.8 ... 7 MHz bands.

Beverage on ground

The classic Beveredge antenna requires a lot of space and support stands. This causes obvious difficulties. HAMs have tried to place the antenna wire directly on the ground (1, 2, 3). Such an antenna is called Beverage on ground (BOG).

This article describes one possible BOG implementation for the 1.8 ... 7 MHz bands.

Choosing the antenna length. The current in the BOG decays rapidly along its length, unlike the classical Beverage antenna. This is due to the proximity of the ground, which has thermal losses. Therefore, there is no need to make the BOG very long. For medium ground ehe optimal length is 60 to 90 metres. For lengths shorter than 60 m you get poor directivity at 1.8 MHz. If longer than 90 m, than ground losses increase.

Choosing the height of the antenna. As modelling and practice have shown, putting the wire directly on the ground is not the best idea. In this case the directivity is noticeably worsened. But good results are obtained at a height of 2....10 cm. Practically it means that the antenna wire should be simply placed on the grass.

The following four screenshots (Fig. 1 ... 4) show the characteristics of a 60 m long BOG at a height of 3 cm above an average ground (conductivity 5 mS/m, dielectric constant 13). Load resistor Rl = 210 Ohm (200 Ohms + 10 Ohms). Calculations were performed in the GAL-ANA programme on the NEC2 kernel.

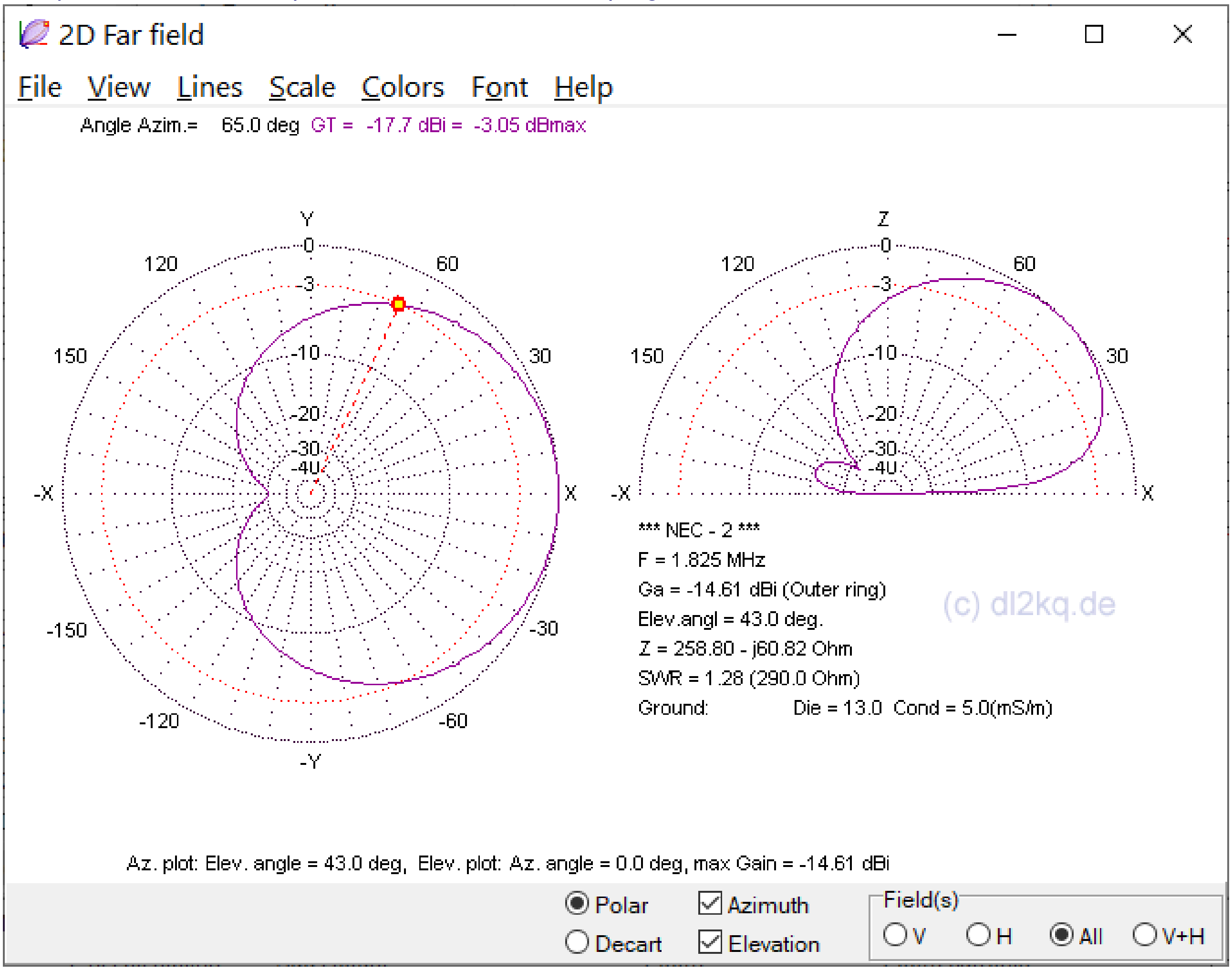

Fig. 1. Band 160 m. L= 60 m. H= 3cm.

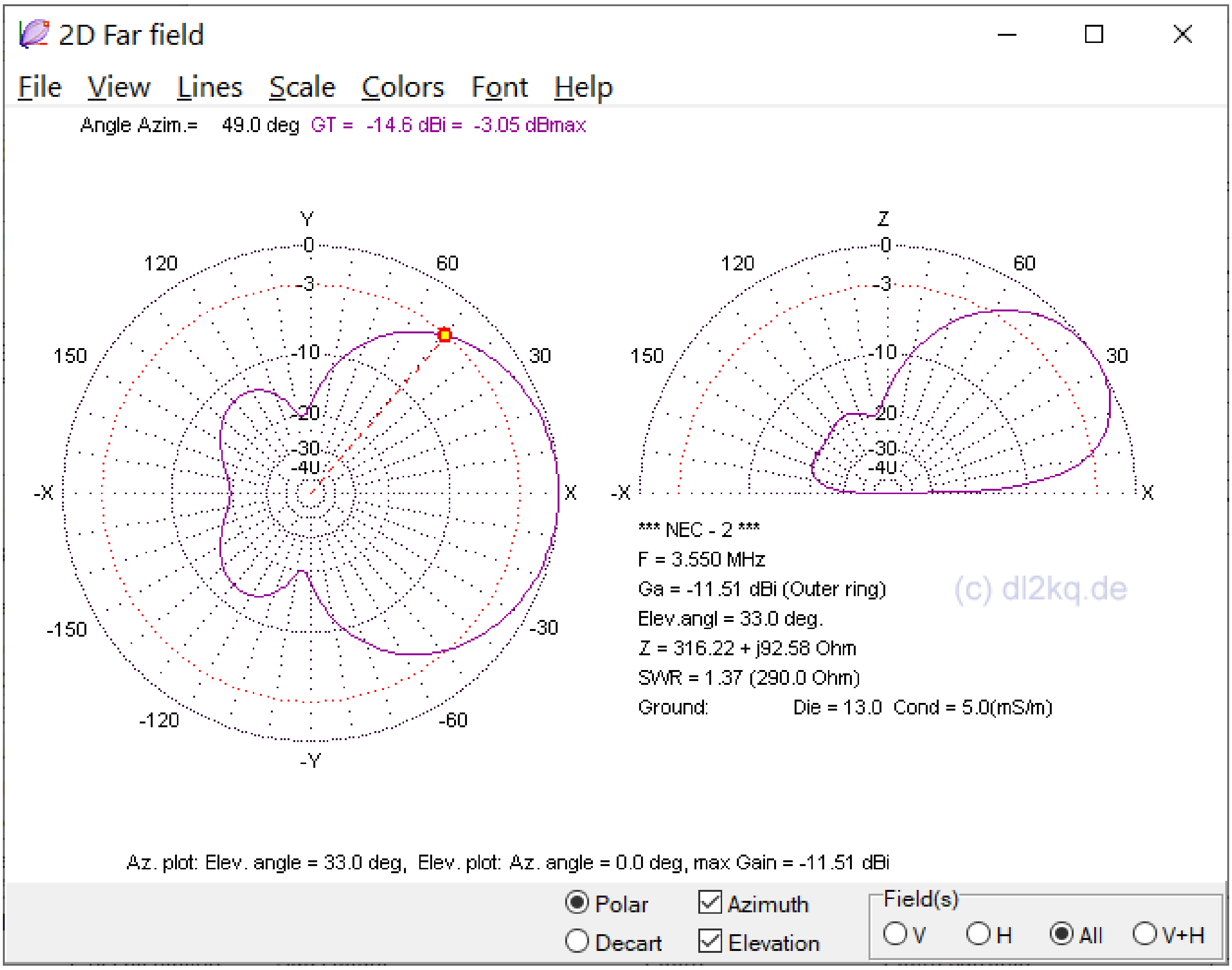

Fig. 2. Band 80 m. L= 60 m. H= 3cm.

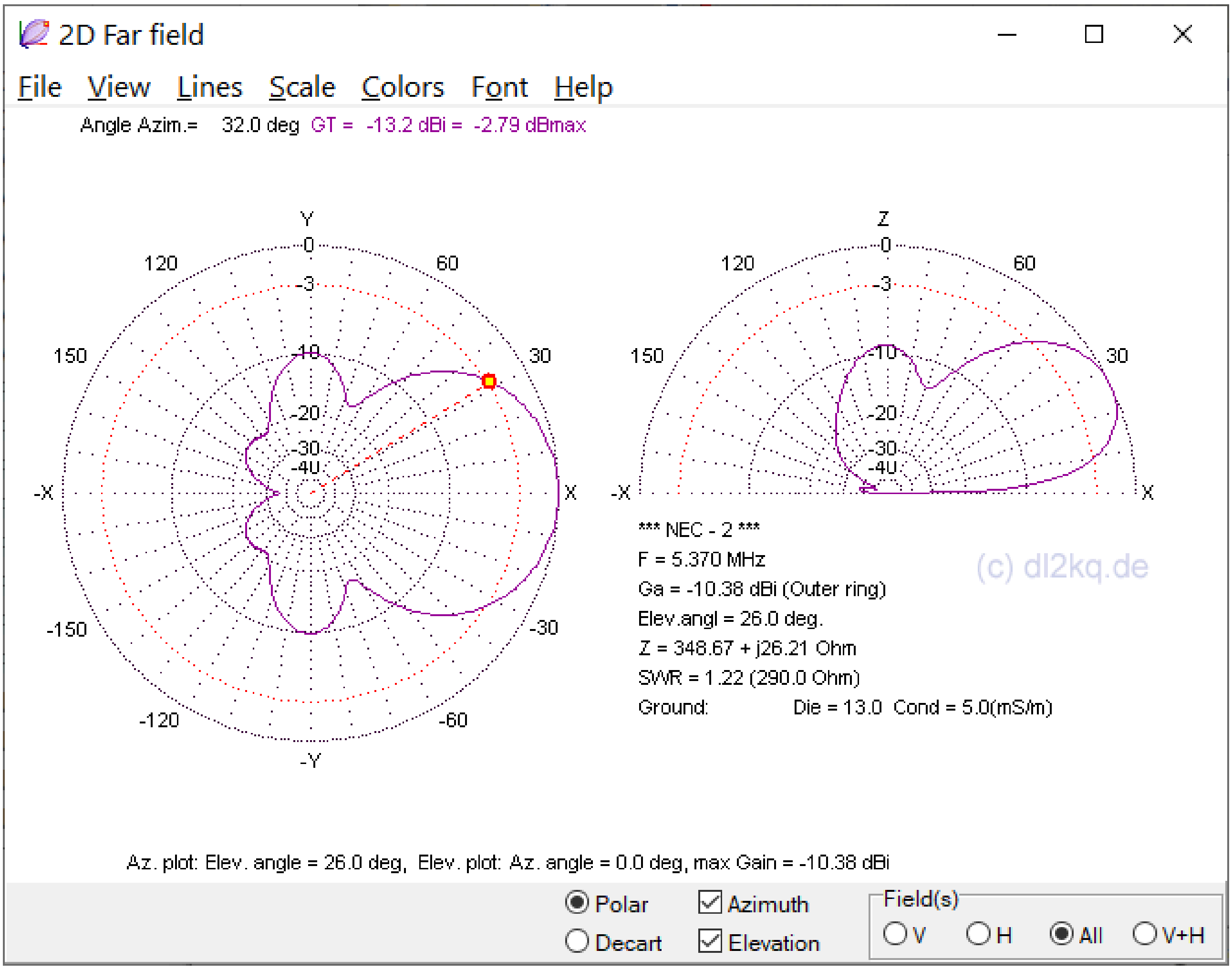

Fig. 3. Band 60 m. L= 60 m. H= 3cm.

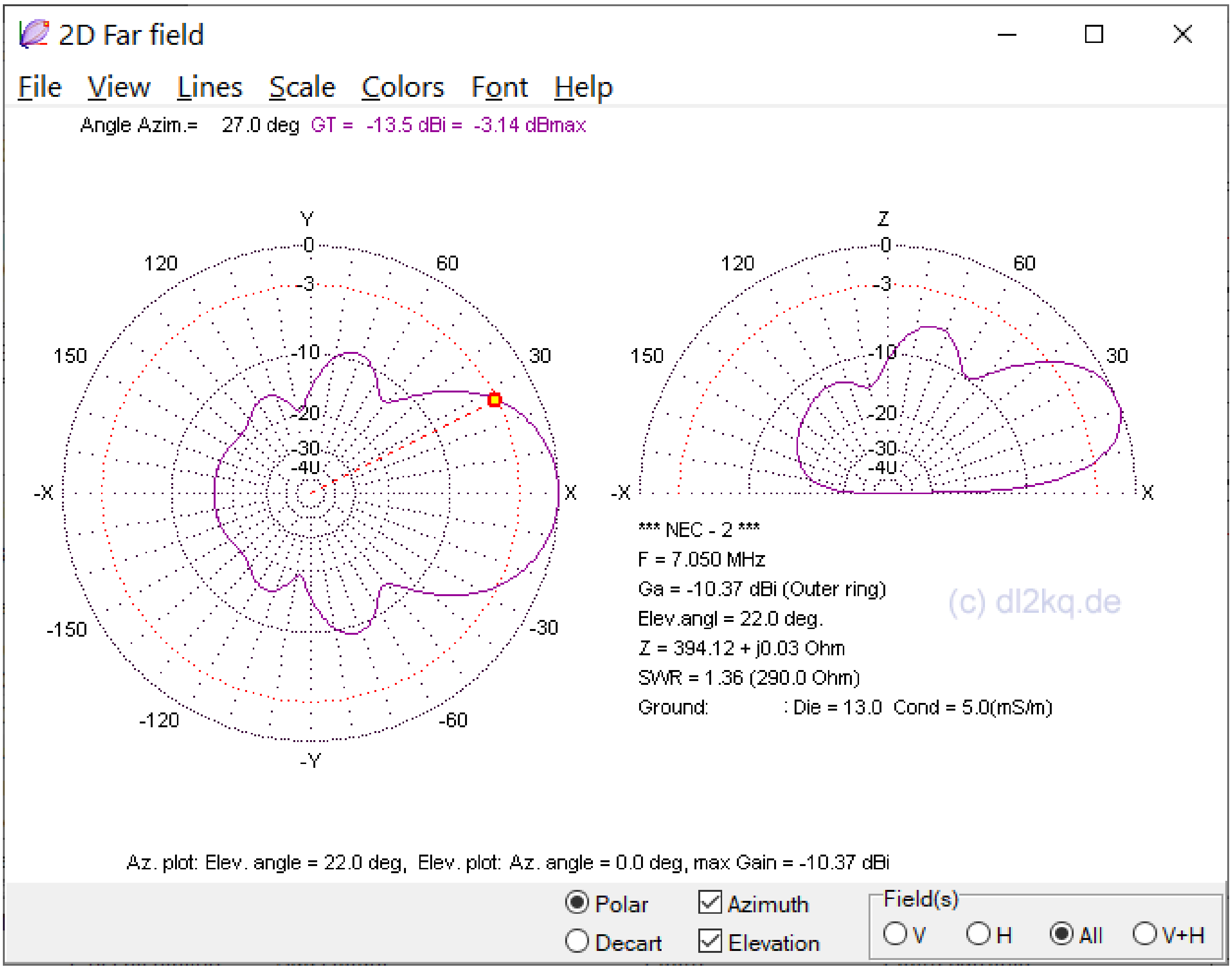

Fig. 4. Band 40 m. L= 60 m. H= 3cm.

The following four screenshots (Fig. 5 ... 8) show the characteristics of a 80 m long BOG at a height of 3 cm above an average ground (conductivity 5 mS/m, dielectric constant 13). Load resistor Rl = 430 Ohm. Calculations were performed in the GAL-ANA programme on the NEC2 kernel.

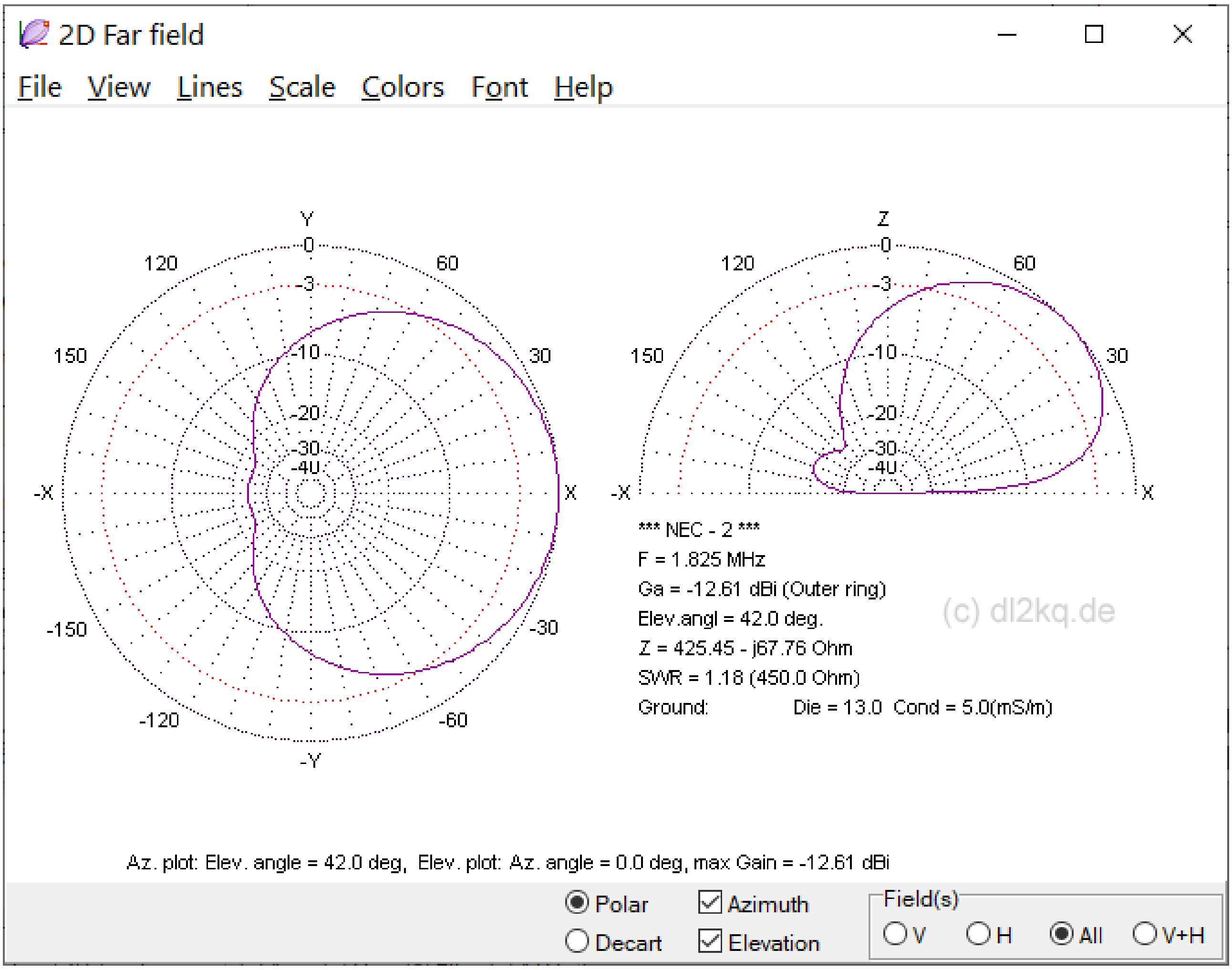

Fig. 5. Band 160 m. L= 80 m. H= 3cm.

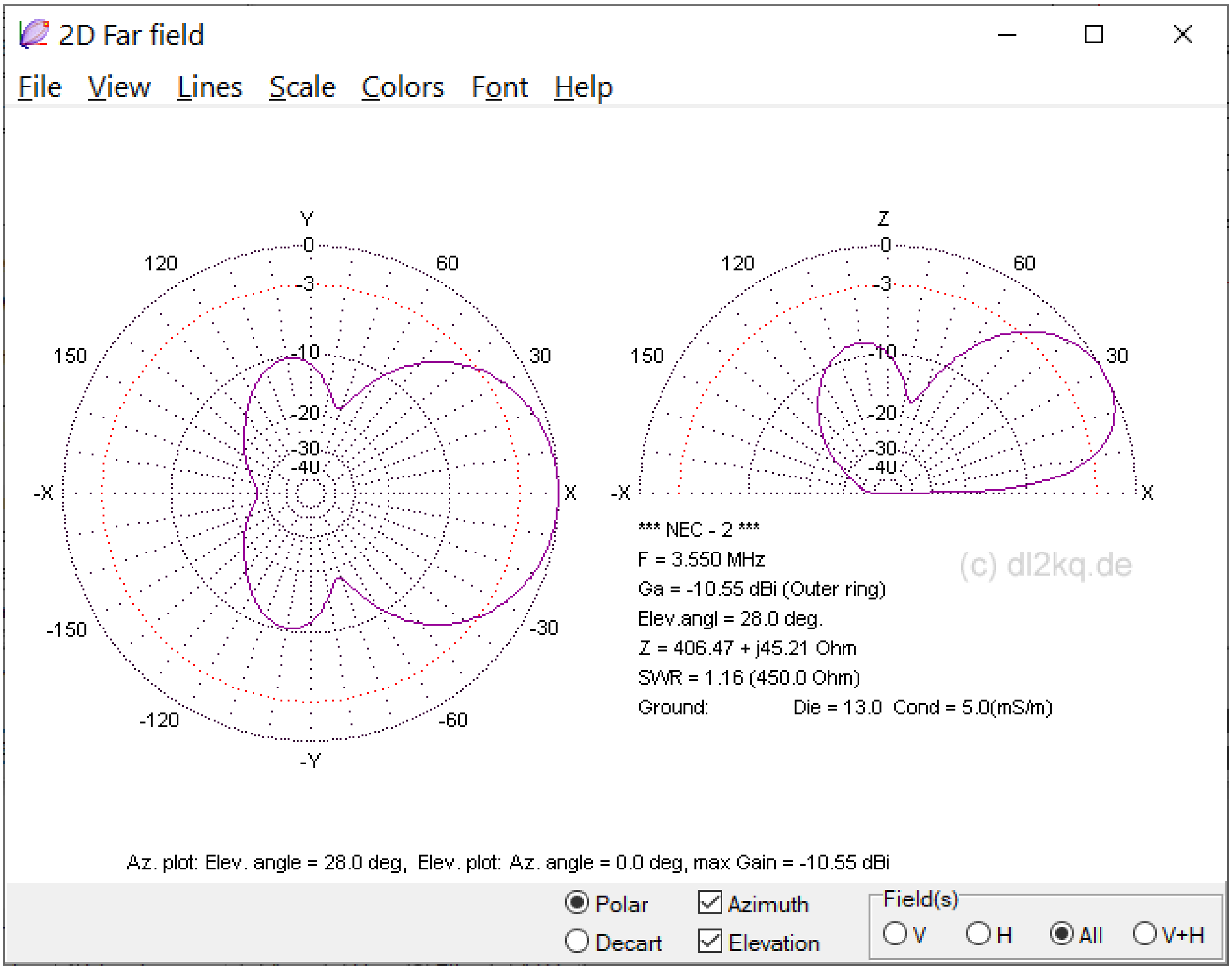

Fig. 6. Band 80 m. L= 80 m. H= 3cm.

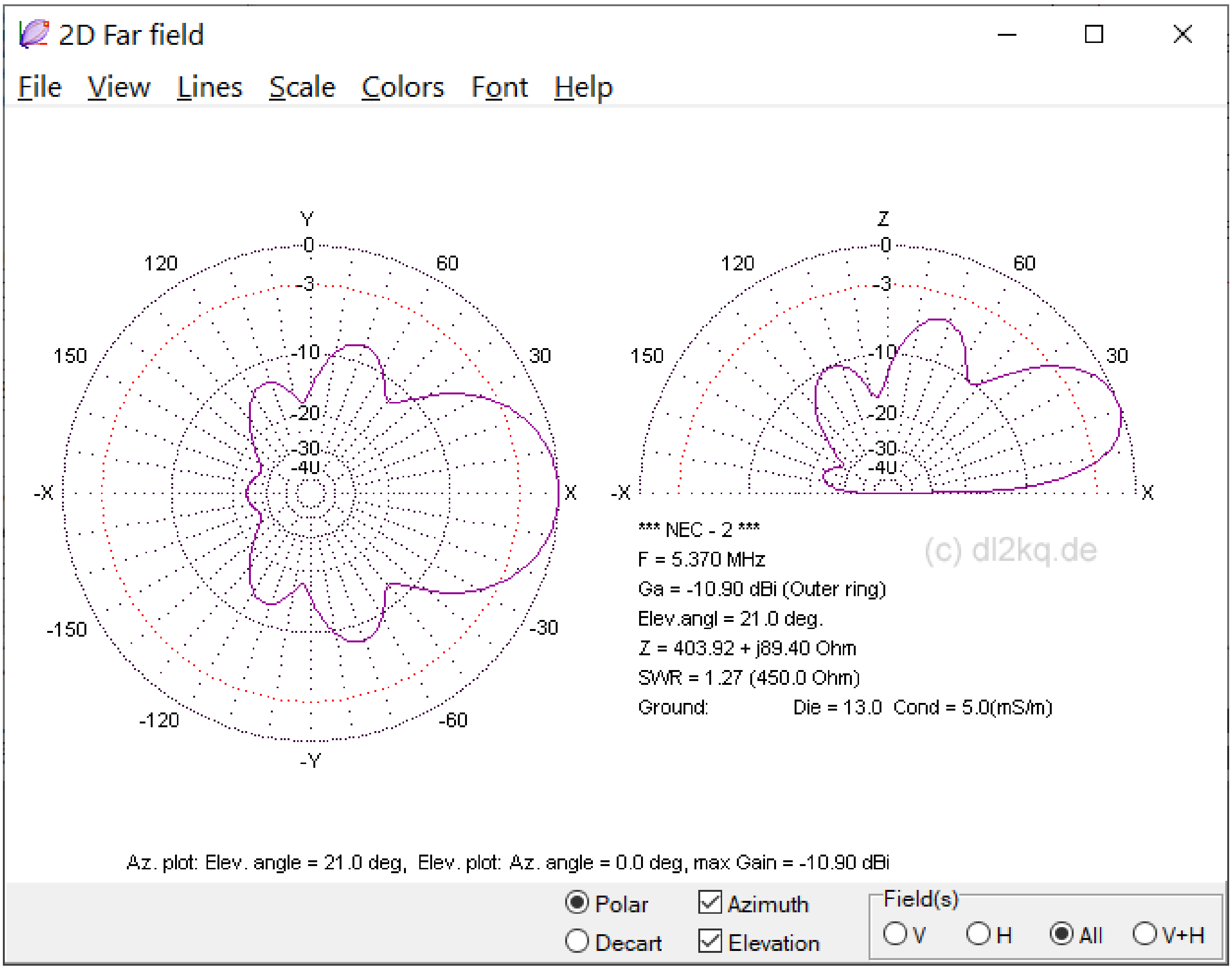

Fig. 7. Band 60 m. L= 80 m. H= 3cm.

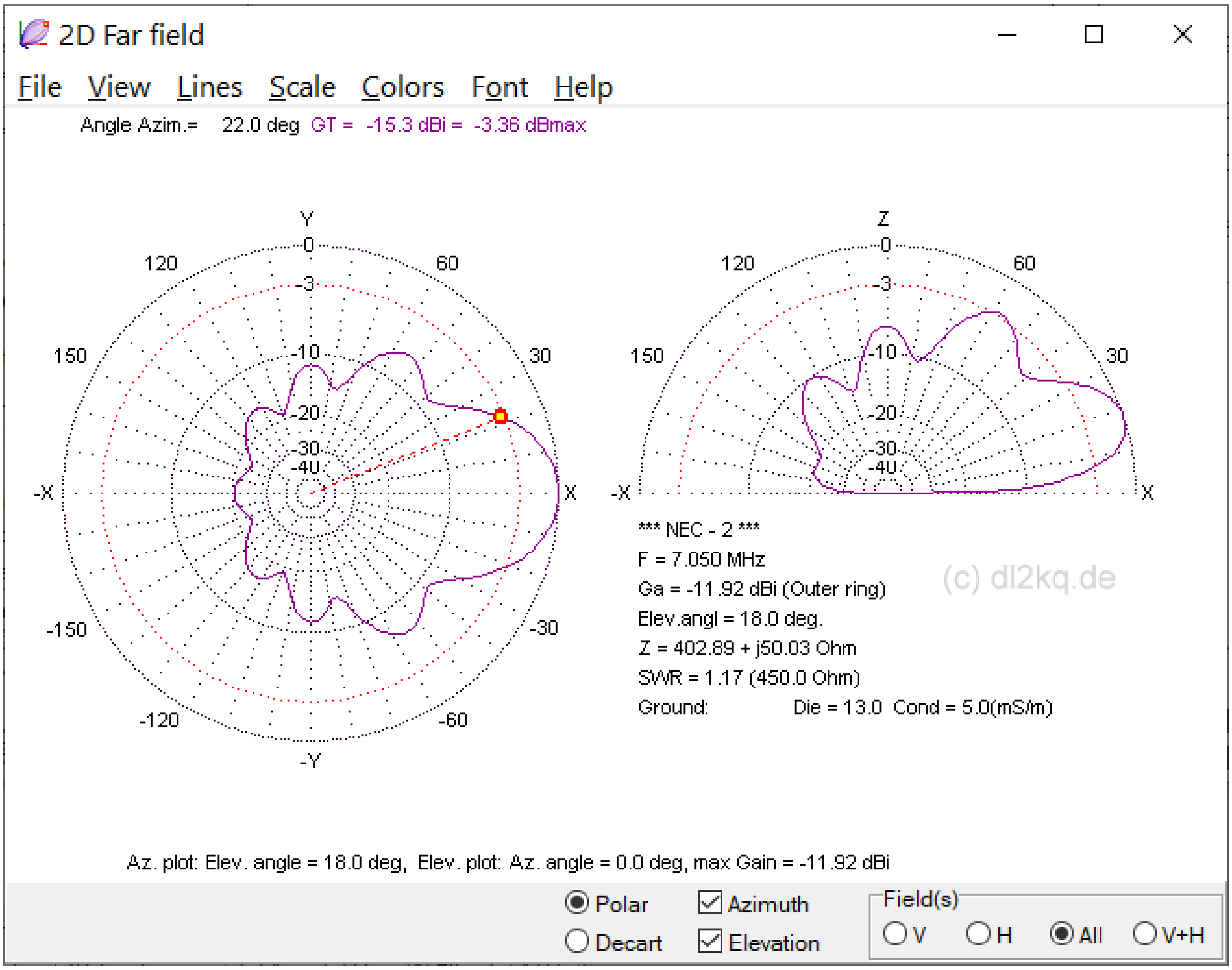

Fig. 8. Band 40 m. L= 80 m. H= 3cm.

Choosing the load resistance Rl. This is the most difficult question in this antenna. Rl depends on the length and height of the antenna wire and the properties of the ground.

If your 60 m long BOG is 3 cm above the an average ground, then use R = 210 Ohm (as is done in the models for which the above screenshots are calculated).

If your 80 m long BOG is 3 cm above the an average ground, then use R = 430 Ohm (as is done in the models for which the above screenshots are calculated).

But if something is different in your case (length and/or height of BOG, properties of the ground), Rl will have to be determined experimentally. To do this you will need: one HAM assistant, a signal source of the required bands (f.e. a separate QRP TX), a receiver (f.e. your main RX or TRX) and an impedance meter.

Methodology:

1. Place the 1.8 MHz signal source from the rear direction BOG at a distance greater than 30 ... 40 m.
2. At the far end of the BOG place a HAM assistant with a 500 ohm trim resistor. This resistor should be connected as the load resistance of the BOG.
3. Connect the BOG to your receiver. At this stage this can be done simply via a 1:4 ferrite transformer. Find the source signal on your main receiver.
4. Use a mobile phone or a small VHF transceiver to contact a assistant.
5. Ask him to slowly turn the trimmer until you get a minimum of signal in your receiver (ALC should be off).
6. Measure and record the resistance value of the tuning resistor.
7. Repeat steps 1...6 for all desired bands.
8. If the obtained values of the resistor Rl on different bands are approximately the same (±10...15%), then replace the trimmer with a constant resistor corresponding to the average value of the obtained results. And let the assistant go :)
9. If the obtained values of the optimum Rl by bands differ significantly, it is necessary slightly (±1...3 metres) to change the length and/or height of the BOG. And repeat steps 1...8.

After you have set the optimum BOG load impedance you should measure the resulting input impedance (it will not be equal to the Rl of the load due to the influence of the close ground). Disconnect the 1:4 time transformer from the BOG and instead switch on the impedance meter in the whole desired frequency band. Analyse the measurements and decide at which impedance source Rs of the BOG supply system the best matching will be obtained. You can get results from 170 to 450 ohms.

For a 60m antenna at 3cm above an average ground, I got 290 ohms.

Choice of feeding system.This system must fulfil two tasks:

1. Eliminate parasitic reception by the coaxial cable braid (common-mode decoupling).
2. Match the BOG impedance to 50 ohms.

To solve the first problem, a few ferrite clips (common-mode choke) must be installed on the feeding coaxial cable. A 1:1 isolation transformer with separate windings and minimum inter-winding capacitance must be installed between the cable end and the matching system. It is also useful to bury the feeding coaxial cable in the ground, at least to a shallow depth.

The solution of the second problem depends on the value of Rs obtained during by impedance measurements.

- If Rs is between 170 and 240 ohms, then use a simple 1:4 ferrite wideband transformer.
- If the Rs is in the 240 to 320 ohm, use special matching filters 50/290 ohm (see below).
- If the Rs is in the 320 to 390 ohm, use special matching filters 50/350 ohm (see below).
- If Rs > 390 ohms, use a 1:9 ferrite wideband transformer.

Fig. 9 shows a schematic of the 50/290 ohm filter, Fig. 10 its characteristics: transmission coefficient S21 and matching S12. Filter model in RFSim99 programme format.

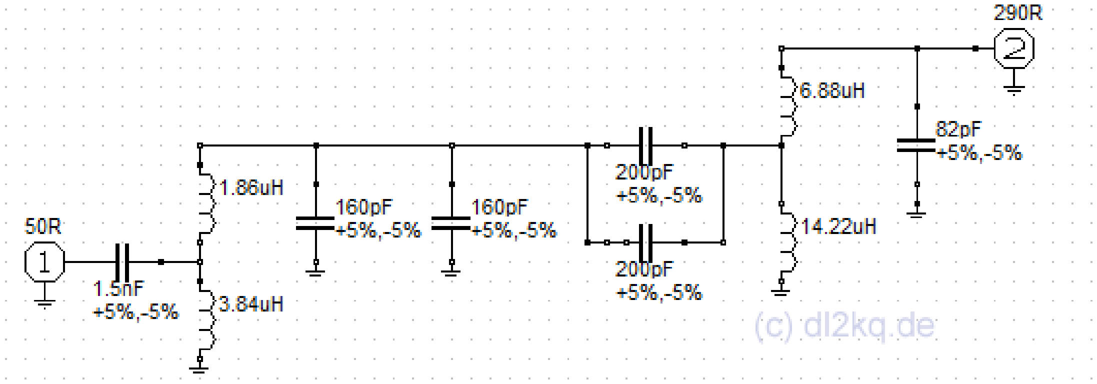

Fig. 9.

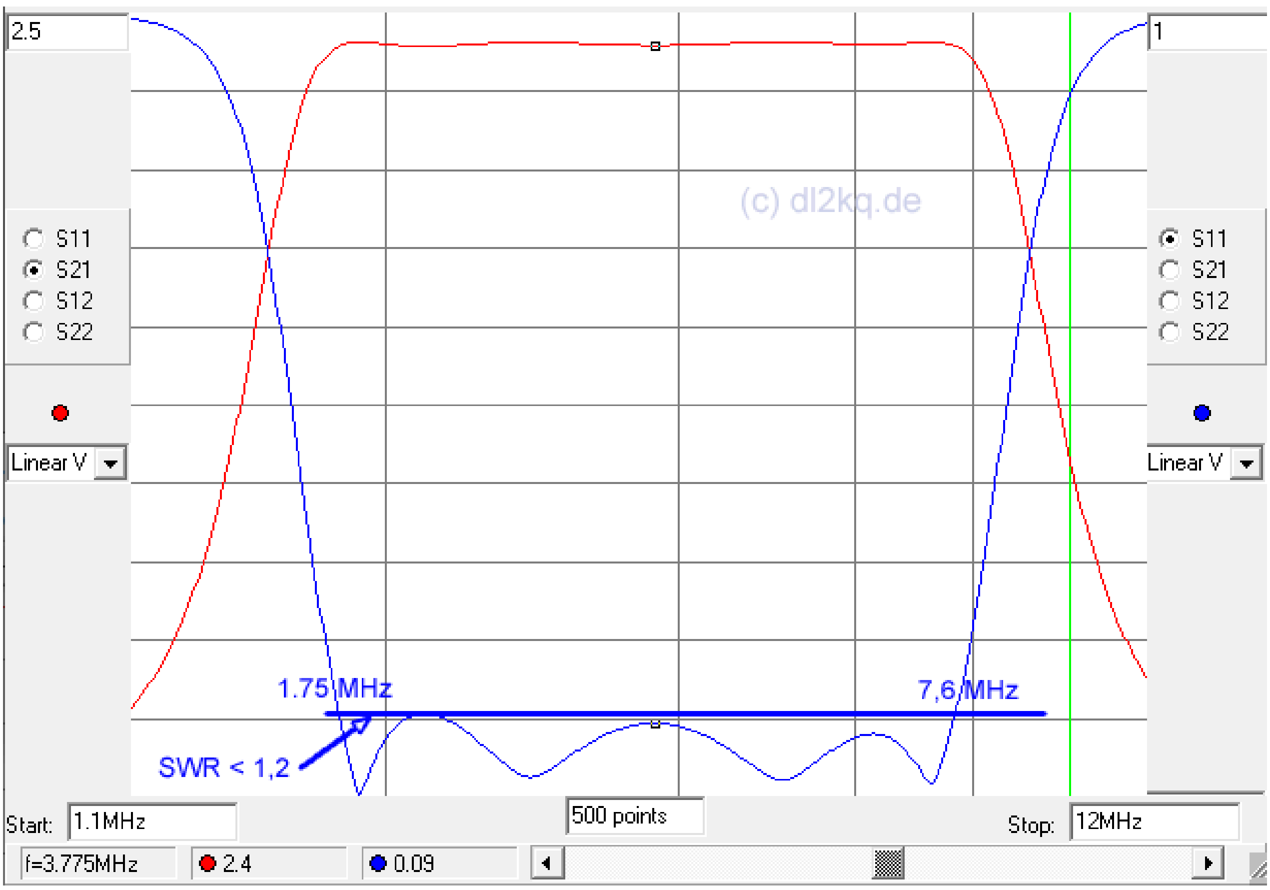

Fig. 10.

Fig. 11 shows a schematic of the 50/350 ohm filter, Fig. 12 its characteristics: transmission coefficient S21 and matching S12. Filter model in RFSim99 programme format.

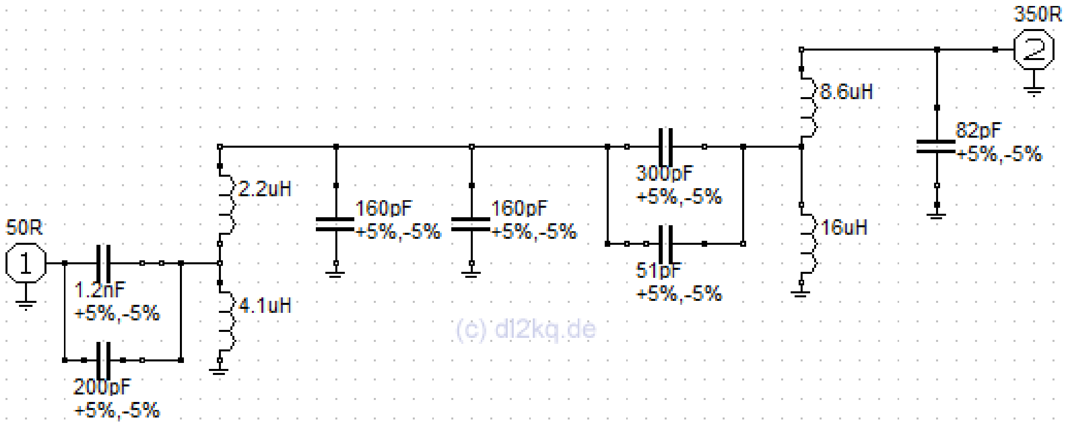

Fig. 11.

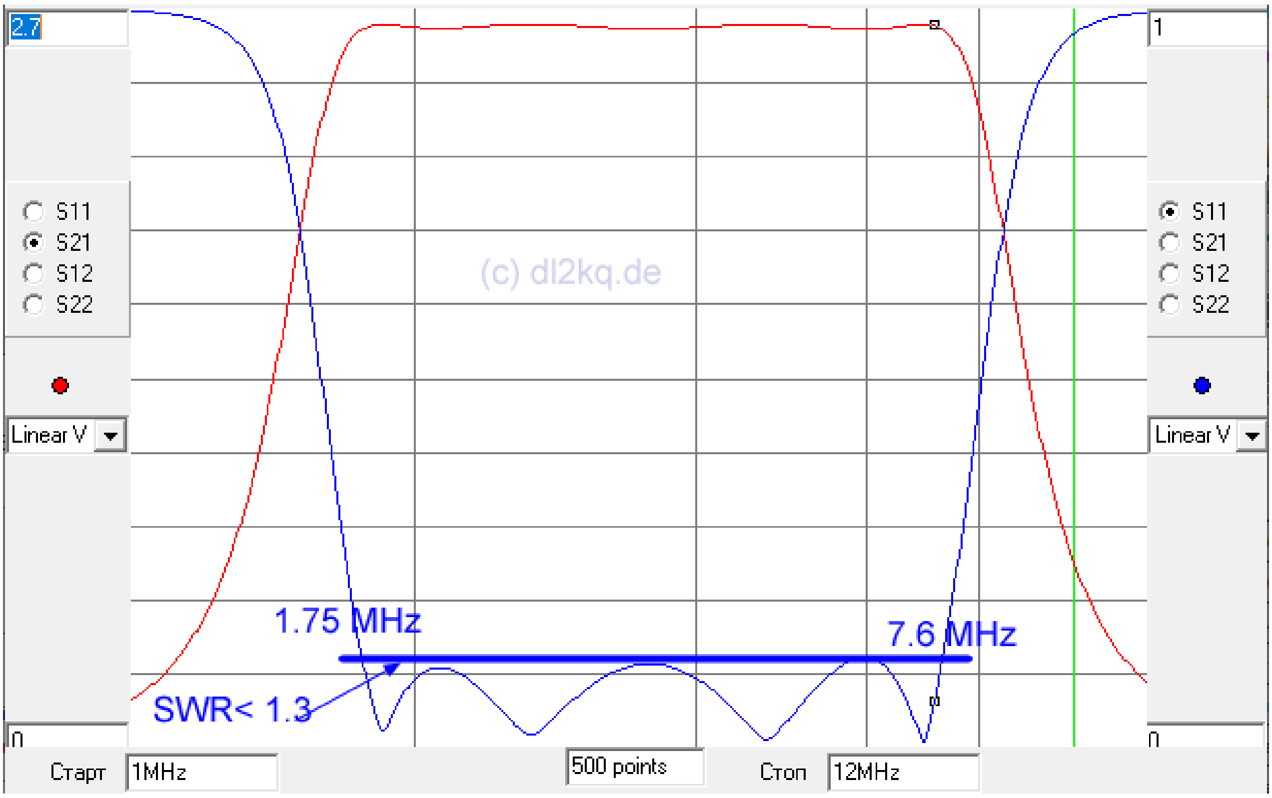

Fig. 12.

Both filters use a standard range of ±5% capacitors. Adjustment of the filter capacitors is not required.

Adjustment of the filters is done by tuning cores of the coils. Since the filters have a frequency margin, tuning is not difficult.

Conclusions

BOG allows for directional receive from 1.8 to 7 Mhz at relatively short lengths (just negotiate with a couple of your nearest neighbours).

Of course, the BOG operates worse than the classic Beverage 200...300 metres. But still BOG is a directional antenna of relatively compact dimensions.

The price for the simplicity of BOG is the strong dependence of its parameters on the ground properties. Therefore, a rather complicated procedure of experimental determination of the load resistance is necessary. In addition, changes in ground parameters due to rain or drought will reduce F/B ratio.

Notes

1. Carl Luetzelschwab K9LA April 2017. Trends in Beverage and BOG Performance.
2. Rudy Severns, N6LF. The Case of Declining Beverageon-Ground Performance, QEX July/August 2016 pp 7-17.
3. Mark Van Wijk, PA5MW. Beverage On Ground (BOG).

25.10.2024

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