Ideas @ Projects

for QRP

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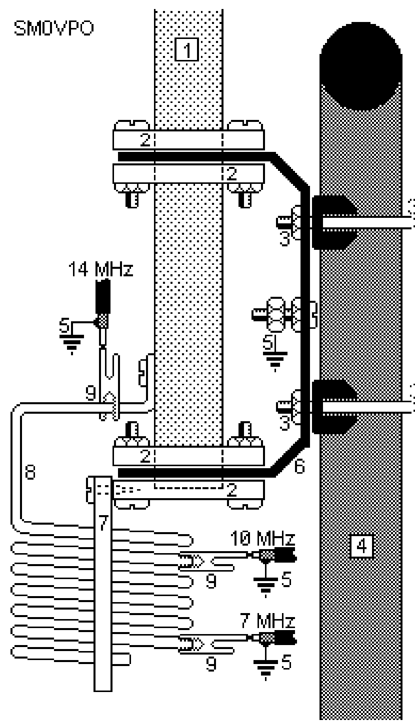
HF ANTENNAS

Balcony Antenna

by **Harry Lythall - SM0VPO**
mailto: sm0vpo@telia.com
Credit Line: http://web.telia.com/~u85920178/

Many amateurs are very restricted with the space they have available for HF antennas. I have documented a short antenna for the HF bands, but here is a simple method of mounting it, and a method of further reducing the physical length. I used to use an old CB (27 MHz) half-wave antenna which had a broken matching coil. this I used as a 1/4 - wave antenna for 14 MHz, after removing the matching coil. Today I find that CB antennas have increased in price, so I have found a cheap replacement that can be fitted to the balcony of apartment dwellers.



THE ANTENNA

Above is the side view of a bracket, which can be thrown together in a couple of hours and gives surprisingly results. I use six sections for the antenna itself, each of which is 1 meter long. Each section fits inside the previous section by exactly 10 cm. the last section is adjusted so that total length of the antenna is 5.35 meters. This resonates at 14.1750 MHz. I used the following aluminum tubes:-

section 1 : 31 mm Dia. Wall thickness = 2.0 mm. (bottom section)
section 2 : 25 mm Dia. Wall thickness = 2.0 mm.
section 3 : 20 mm Dia. Wall thickness = 1.5 mm.
section 4 : 15 mm Dia. Wall thickness = 1.5 mm.
section 5 : 10 mm Dia. Wall thickness = 1.5 mm.
section 6 : 6 mm Dia. Wall thickness = 1.0 mm. (top section)
This is shown as item (1) in the drawing above.

THE BRACKET (6) & (2)

The bracket screws on to a handrail of the balcony. In my present situation I have a 7 meter wide terrace with a horizontal handrail, but there are four vertical steel pipes supporting the handrail. The bracket is screwed on to one of these vertical supports (4). The bracket is formed using 3 - 4 mm thick aluminium plate (6) with a 50 mm hole in the center of the top & bottom ends. Bend the plate in two places to prevent the plate becoming weakened. The two ends are each sandwiched in between two nylon blocks (2). Use a chopping board stolen from the kitchen, if you can get away with it. Otherwise, the chopping boards are available from:
IKEA (Sweden)
WOOLWORTHS (UK)
SAFEWAY (USA)

Drill THREE of the nylon blocks, in the center, to fit the 31mm tube (1). The fourth block (bottom) should be drilled with a 5 mm hole to allow water to run out. The bracket is bolted to the balcony handrail, using 35 mm exhaust (muffler) clamps (3).

THE COIL (7) & (8)

This is used to make the antenna resonate at lower frequencies. I wound all my coils using 4mm aluminum wire, but copper hydraulic brake pipe works as well. The coil is 10mm Dia (the same as a tin of DelMonte pineaple chunks)! The coil pitch is 1cm per turn. I used two pieces of plastic conduit (7) to support the coil.

The coil uses about 1 meter of wire/pipe for every three turns. Flatten one end and drill a hole in it for connecting it to the antenna pole (1). If you use aluminum wire, then shorter pieces can be joined together with a brass insert from a car cable connector. Copper tube can easily be soldered.

FEEDING THE ANTENNA (5) & (9)

Feed the antenna with 50 ohm coaxial cable, braid connected to the bracket (5) and the center conductor connected to an aligator clip. Select the band using the aligator clip (9):-

0 turns = 14 MHz (20 meter band) (VSWR - almost 1:1)

2 turns = 10 MHz (30 meter band) (VSWR - almost 1:1)

6 turns = 7 MHz (40 meter band) (VSWR - about 1.1:1)

51 turns = 3.8 MHz (80 meter band) (VSWR - about 1.4:1)

53 turns = 3.7 MHz (80 meter band) (VSWR - about 1.4:1)

55 turns = 3.6 MHz (80 meter band) (VSWR - about 1.4:1)

57 turns = 3.5 MHz (80 meter band) (VSWR - about 1.4:1)

Here is a photograph of one of the prototypes in my balcony. In the background you can just make out another one of these antennas, but with a bigger (63 turn) coil.

OTHER INFORMATION

The mounting is very rubust, yet the wind resistance is rather low. Both my antennas have stood up to gale force winds; they hardly wobble!! You do not have to use 5.35 meters of for item (1) if you want to work on other bands, such as 18 MHz.

If you intend to use more than 10 watts, then make sure you have a good
1 cm, or more, of insulation between the aluminium pole (1) and the bracket (6).

Have fun with this project. Regards from Harry - SM0VPO **-73!-**

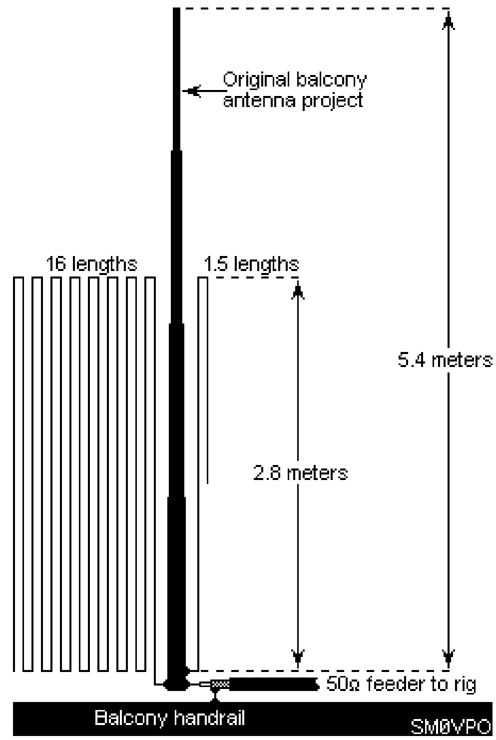
Balcony Antenna Extension

by **Harry Lythall - SM0VPO**
mailto: sm0vpo@telia.com
Credit Line:
http://web.telia.com/~u85920178/antennas/balcant2.htm

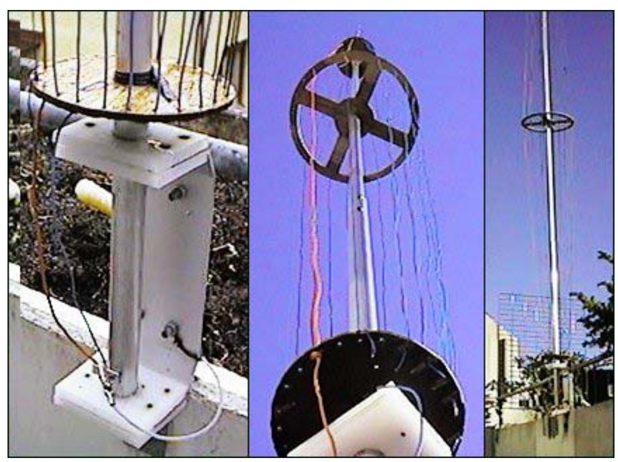
You may have already seen my HF Balcony Antenna which was designed solely for 14MHz, then a coil was added to cover all the lower HF bands (10, 7 and 3.5MHz). Following an article in RadCom I have now extended this antenna to cover all bands from 3.5MHz through to 30MHz without any switching or tuning. The antenna functions using both Fractal and Meander principles. The height of one turn of the loop gives coverage of the 10-meter band, the old balcony antenna covers 20-meters, an extra element covers 17-meters and the 40-meter long meander gives coverage on the 80-meter band. Here is the measured range of the complete prototype antenna:

Band	Range (MHz)	Worst VSWR	Center VSWR
80 m	3.55 - 3.70	3:1	1.1:1
40 m	7.00 - 7.10	2.2:1	2.2:1
30 m	10.10 - 10.15	2.3:1	2.3:1
20 m	14.00 - 14.35	1.1:1	1:1
17 m	18.07 - 18.17	1.2:1	1.2:1
15 m	21.00 - 21.45	2.8:1	2.5:1
12 m	24.89 - 24.99	2.1:1	2.1:1
10 m	28.00 - 29.20	3:1	1.1:1

As you can see, the VSWR rises on some of these bands but the antenna is still 100% useable on all bands without an ASCTU (ASTU or ATU). I have not tested the coverage outside amateur bands, I stopped when the VSWR became 3:1 or when the band edge was encountered. So what is the big secret? I have mentioned before in these pages that several 1/4-wave or 1/2-wave antennas can be placed in parallel and fed with a single feeder. The resonant element will have an effect; the others presenting a high impedance. I tried to add two 1/4-wave antennas to cover the original 14MHz plus 29MHz, 18MHz and 3.6MHz. When I tried it I was surprised that the antenna covered as much as 200KHz of the 3.5MHz band and other HF bands were ALL useable. Reports suggest that the effects on 14MHz have introduced a couple of dB's loss, but that is far less than one "S-point". Here is the drawing of the antenna showing the original 14MHz pole (center) and the other two 1/4-wave antennas I have added.



I have shown a graphic likeness of the routing of the additional 43-meters of wire, they are wound on three plywood disks. The top and bottom disks are 100mm diameter and the center spacer disk is 300mm diameter, each drilled with 18 holes. It would have been better to have used nylon food reparation boards (from Ikea) but I didn't really have all that much confidence this antenna experiment would work so I began with this make-shift arrangement. I must also point out that putting your hand near this antenna will cause changes to the readings, so you may need to make a few minor adjustments in your own individual case. Here are photographs of the finished and working prototype antenna.



The left insert shows the antenna mounted on the old balcony support bracket with the coil removed. The center insert shows a view from the bottom of the antenna. The orange wire is the 420cm 18MHz element. The right insert shows most of the complete antenna from a little distance. Notice how I have cut out material from the center spacer to reduce wind resistance and to help make it look a little less obtrusive for neighbors. The top spacer is identical to the bottom spacer. All three of the elements are connected in parallel at the feed point where I connected my 50-ohm feeder. The old coil is now obsolete and has been removed.

Please note that this antenna idea is also governed by "Harry's Law" of coils:

You cannot wind coils like me and I cannot wind coils like you.

Coil-winding data is a constant that varies from person-to-person.

This means that it may NEED some adjustment in your own environment, depending upon proximity of other artifacts, humidity, groundplane efficiency and even the color of the flag you have fitted to the top of the original 14MHz pole.

Begin antenna assembly by making and fitting the top, middle and bottom spacers. To trim the spacers, temporarily add a 3-meter length of wire, making a small tight loop at the top to remove the surplus. Check the VSWR at 29MHz and adjust the top-spacer position, re-coiling the surplus wire, until the antenna is resonant with VSWR better than 1.5:1. Fix the spacer positions using hose-clamps or whatever other bright ideas you may have. Now remove the 3-meter wire and sew the 40-meters of wire through the holes. Check the VSWR at 3.6MHz, or whatever part of the 80-meter band you want. Remove wire to achieve resonance. Fit the 1.5-loop, 4.2-meter length of wire for the 18MHz element. This loop only comes 1/2-way down the cage, so add some nylon line and secure it to the bottom spacer. Do not tie anything to the center spacer. The wire I used was 7-ampere multi-strand household mains-wiring cable.

Have fun with this project. Regards from Harry - SM0VPO -73!-

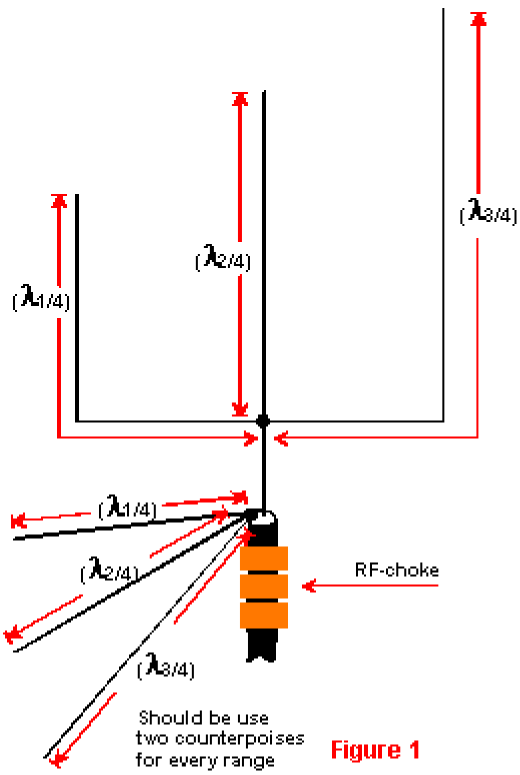
MULTIRANGE VERTICAL ANTENNAS

Igor Grigorov, RK3ZK
antentop@mail.ru

A combined three-band antenna

Three band antenna fundamentals: At a lack of the place for installation of a separate vertical antenna for each of three upper HF ranges it is possible to use a combined three-band antenna that works at the ranges itself. **Figure 1** shows schematic of a combined three-band antenna.

Figure 1 A combined three-band antenna



The antenna consists of from three quarter-wave verticals that are resonated for each of working ranges. The verticals are connected in the bottom together. Two quarter-wave counterpoises should be use for each operation range of the antenna A coaxial cable with 50-Ohm characteristic impedance will do well for the antenna. A coaxial cable with 75-Ohm characteristic impedance also would be work with the antenna, but a SWR in the coax will be higher compare to 50-Ohm coaxial cable. **Table 1** shows the combination of ranges where a mutual influence of vibrators against each other is minimum.

Design of the Antenna: Three various designs of the three- range antenna are shown below. **Figure 2** shows a simple design suitable for 6 - to 15-M. The three vibrators are placed on a small distance from each other. The distances between the vibrators are fixed with the help of small plastic insulators. The design has very strong mutual influence for every vibrator against each other.

Table 1

6m	10m	15m
10m	15m	20m
12m	17m	30m
15m	20m	40m
15m	17m	20m
20m	30m	40m
30m	40m	80m
40m	80m	160m

Figure 2 Simple design of a three ranges antenna

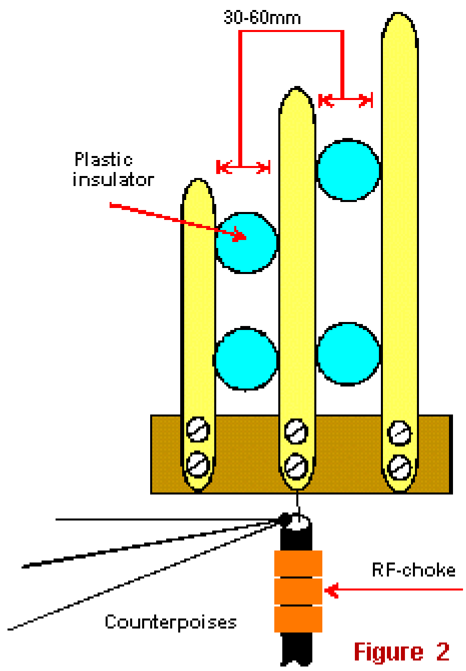


Figure 3 shows a simple design suitable for 6 - to 17-M. Antenna has the triangular shape. Special 'sitting' should be used for the antenna design. Vibrators are screwed in the bottom with the help of strong screws. The design has a small mutual influence for every vibrator against each other.

Figure 3 A triangular shape antenna design

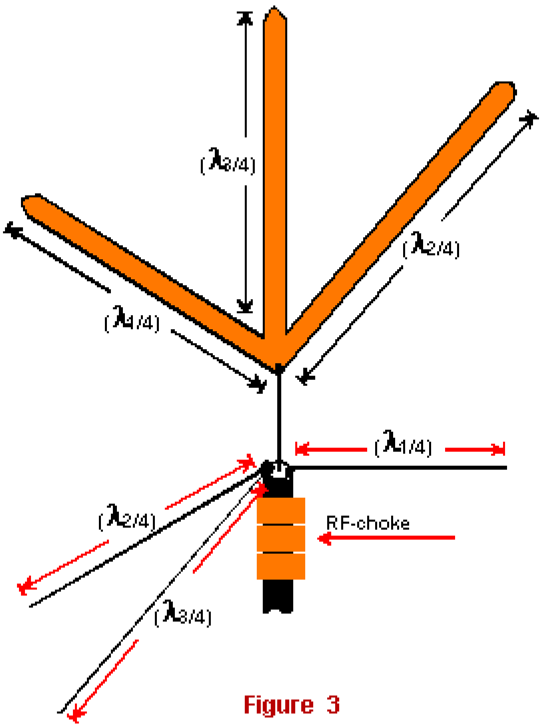


Figure 3

Figure 4 shows a simple design suitable for 6 - to 30-M. Vibrators are screwed to a strong metal angle.

Figure 4 A three range antenna on a metal angle

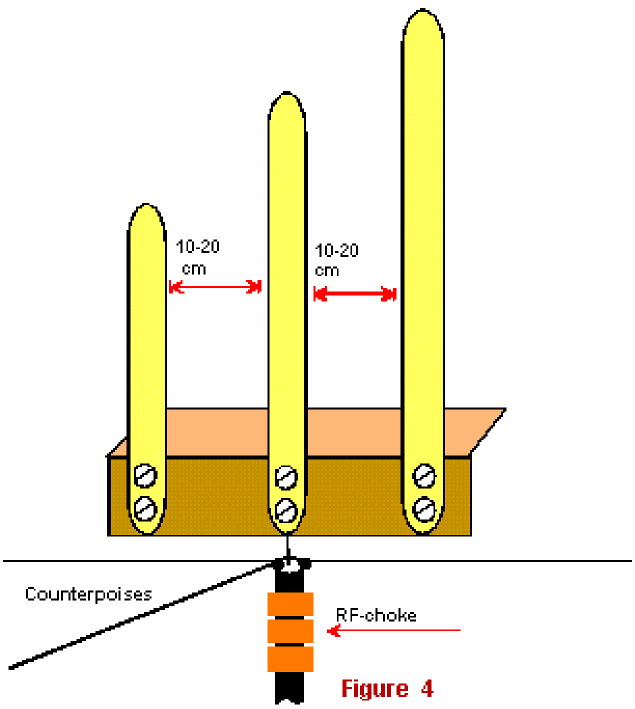


Figure 4

Distances between the vibrators are 10 -30 centimeters. It is decrease the mutual influence of the vibrators to each other.

Antenna Adjusting: The antenna is adjusted by changing lengths of the vibrators. It is not complicated. One way is to move vibrators relatively the metal base, as it is shown in **Figure 5**. Do it carefully, because the vibrators have mutual influence to each other. It needs to do additional holes on to end of the vibrators for realization of the way. It is possible to do one of the vibrators. This method always gives a good result.

Figure 5 A three range antenna adjusting

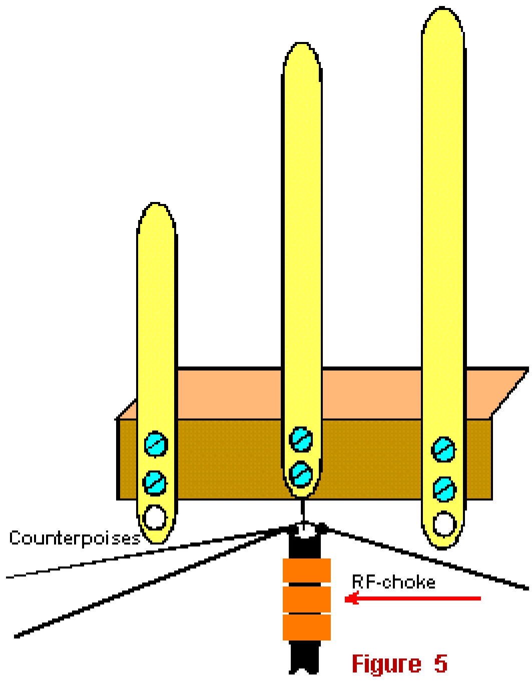


Figure 5

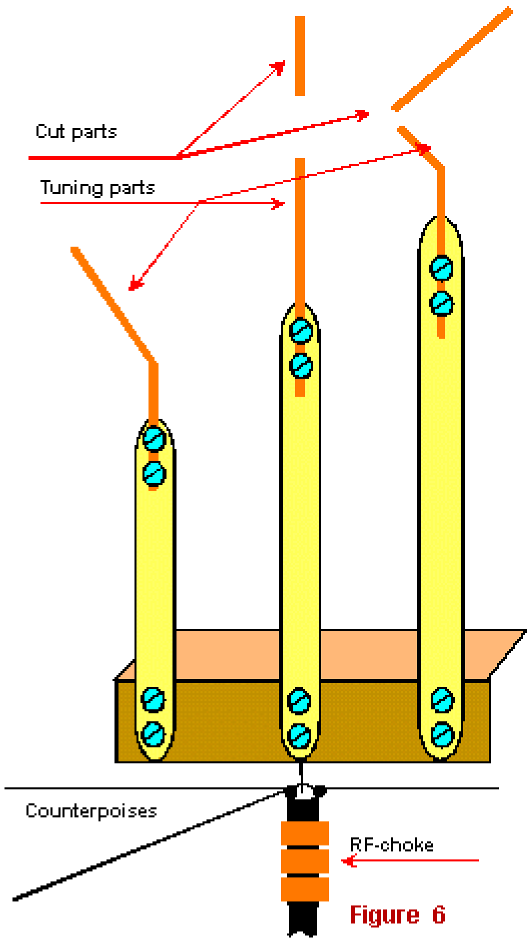
Other way is to change lengths of the upper ends of the vibrators. The vibrators ends made from thick copper or aluminum wire. The wire may be shortened, move in the side, as it is shown in **Figure 6**. But at the way an amateur must have access to ends of the antenna.

A three ranges antenna for the low ranges

Figure 7 shows a simple design suitable for 40 - to 160-M. Vibrators made from a copper wire in diameter 1 to 2 mm. Vibrators have length (λ/4)*1.1. Each vibrator is matched with coaxial cable with help of its own a 'shortening 'capacitor. The shortening capacitor can have 100-pF at ranges of 6- to 17-M, 150-pF at ranges of 20- and 30-M, 200-pF at ranges of 40-80 meters, 250-pF at 160-M. The shortening capacitors should be placed in a whether- proof box.

Figure 8 shows another simple design suitable for 40 - to 160-M. Vibrators made from a copper wire in diameter 1 to 2 mm.

Figure 6 A three range antenna tuning with the help of thick wire



Vibrators have length (λ/4)*(0.5-0.9). Each vibrator is matched with coaxial cable with help of its own a 'lengthening' coil. You can use this design if you have a lack of place.

It is not wise to use more than three vibrators for a multi- range vertical antenna, because overall efficiency of the antenna drops in this case. Such multi- vibrators antenna will be too complicated at adjusting.

Remember: Two and more resonance (a quarter wave) counterpoises for each operation range of the antenna should be used. However, if the antenna is placed at a small altitude above a metal roof and the braid of the coaxial cable has a good electrical contact with the metal roof, the antenna could be used without any counterpoises.

RF – choke should be used: An RF- choke on the coaxial cable should be installed at feeding terminals. . The RF-choke precludes leaking of RF- currents on to outer braid of the coaxial cable. Without the RF-choke the outer braid of the coaxial cable serves as a radiating part of the vertical antenna. It gets to TV and RF- interferences when the antenna operates on transmission. 10 - 30 ferrite rings (permeability does

Figure 7 A simple design suitable for 40 - to 160-M

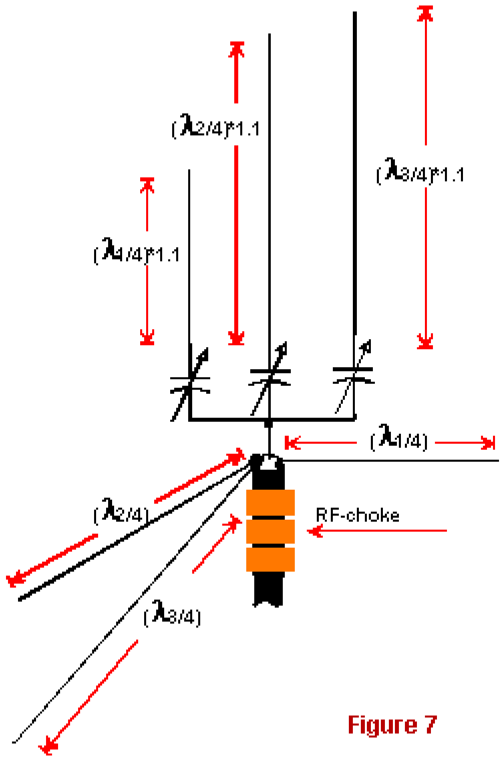
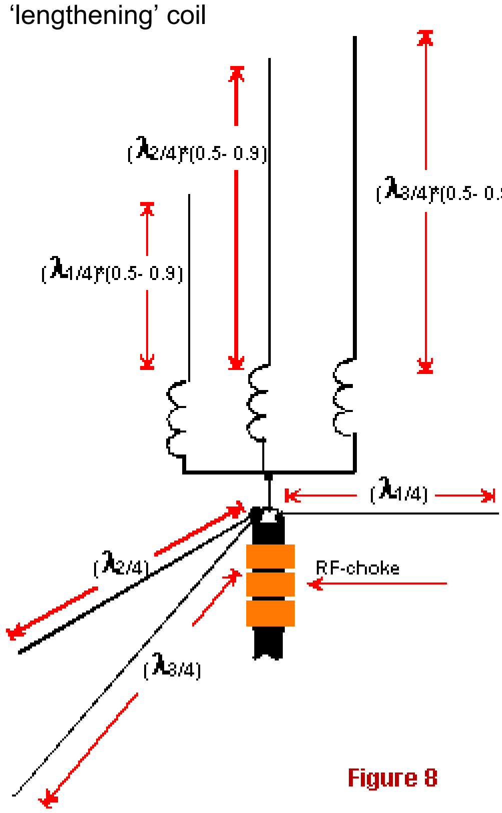


Figure 8 A simple design suitable for 40 - to 160-M with 'lengthening' coil



not matter) hardly dressed on the coaxial cable end at the antenna terminal make the RF-choke.

Practical Design of Open - Sleeve Antennas for Upper Amateur HF - Ranges

By Dmitry Fedorov, UA3AVR

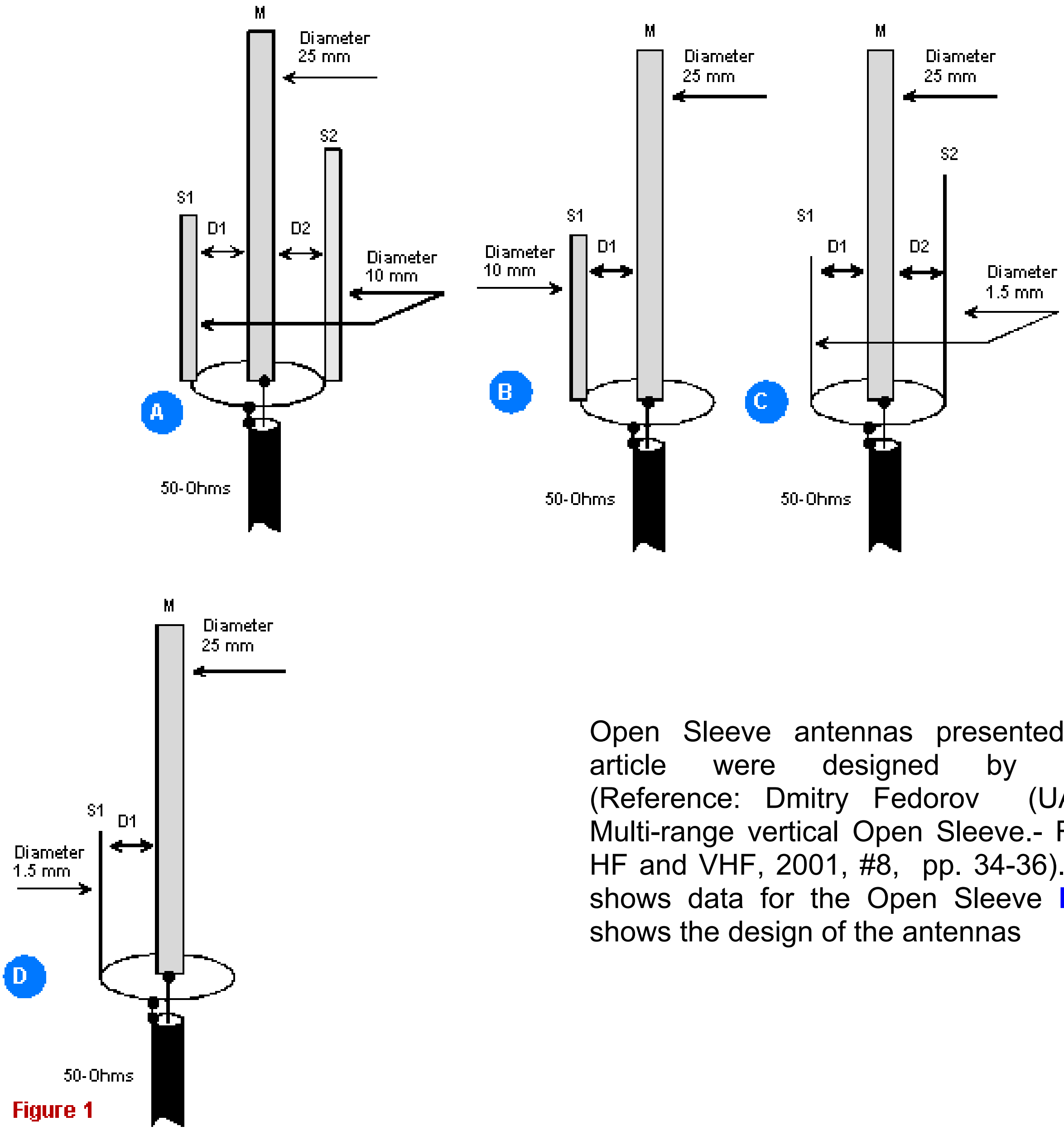


Figure 1

Open Sleeve antennas presented at this article were designed by UA3AVR (Reference: Dmitry Fedorov (UA3AVR).: Multi-range vertical Open Sleeve.- Radiomir. HF and VHF, 2001, #8, pp. 34-36). **Table 1** shows data for the Open Sleeve **Figure 1** shows the design of the antennas

Band, m	Length M, mm	Length S1, mm	Distance D1, mm	Length S2, mm	Distance D2, mm	Figure 1
20; 14; 10	5168	3407	220	2573	200	A
14; 10	3630	2527	220	-	-	B
20; 14; 10	5149	3451	220	2601	200	C
14; 10	3432	2567	210	-	-	D

Multi- Range Vertical Antenna UA1DZ

by Igor Grigorov, RK3ZK

***Antenna history**: Antenna UA1DZ is a very interesting multi- range vertical antenna designed by known Russian radio amateur UA1DZ. The antenna was very popular in use in the former USSR. Russian radio amateurs widely use the antenna at present days also. The antenna works with a low SWR on 40-m, 20-m and 15m. Firstly UA1DZ told about his antenna in the ether, and after that, lots Russian radio amateurs have did the antenna and Antenna UA1DZ became very popularity. First printing papers about antenna UA1DZ appeared in reference **[1]**. This antenna has gain 3,67 dBi at 40-m, gain 4 dBi at 20-m, gain 7,6 dBi at 15m (reportedly to VA3TTT, reference **[2]**).*

Antenna construction: Figure 1 shows the construction and matching device of multi-range vertical antenna UA1DZ (based on reference **[1]**). The vibrator of the antenna has the length in 9.3 meters and four counterpoises of the antenna have length in 9.4 meters. Why has the antenna such sizes? Well, for his multi range antenna UA1DZ used an old military vertical antenna and this one had such sizes.

If you have not such old military vertical antenna, of course, it is possible to do home made vibrator and counterpoises! The vibrator and counterpoises must be made from copper or aluminum stuff. Do not use iron wire for HF antenna at all! Iron does not work properly in HF transmitting antennas, especially at upper amateur HF ranges.

Guys must be used with the antenna for providing wind strength. Use acryl cord or iron wire "broken" by insulators to one - meter lengths. Base insulator should have high mechanical and electrical strength because antenna vibrator has a large weight and there is high RF- voltage across the base insulator in transmitting period.

Matching device: It is made on one length of two – wire opened line and two lengths of a 75- Ohms coaxial cable. With the matching device the antenna can work on ranges 40-m, 20-m and 15m with a SWR in coaxial cable no more than 2:1. Two wire opened line "A" does initial matching the antenna input impedance with feeding coaxial cable. The line has characteristic impedance of 450 Ohm and one meter initial length. As usual, the line has ended length about 0.7- meter.

Coaxial cable "B" with characteristic impedance of 75- Ohm and with length 2.5 meters makes further matching for input impedance of the antenna system with feeding coaxial cable. An opened on the end length of coaxial cable "C" makes compensation of a reactive part of the input impedance of the antenna system.

Two wire line (part A) and the matching parts B and C must be placed not less the 50 centimeters above the roof. Parts A and B should be placed in straight line. It is possible to coil the part C in a bay.

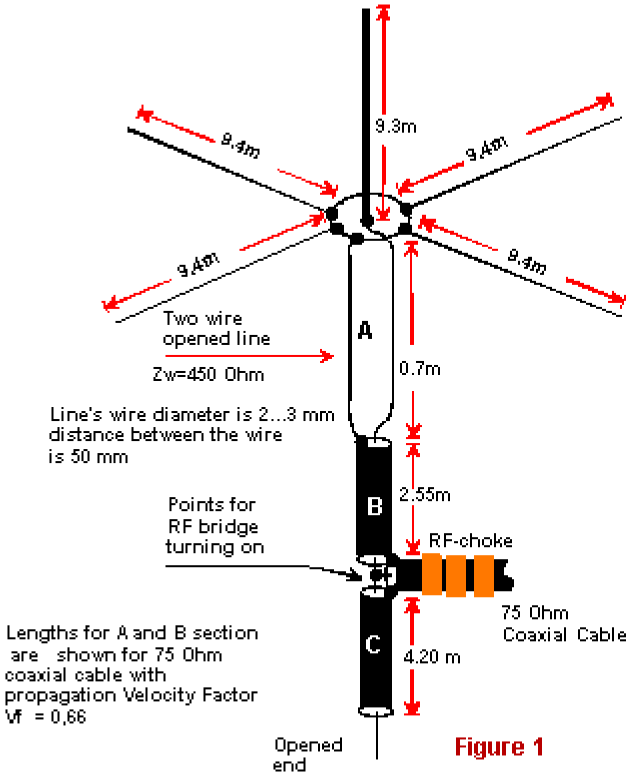


Figure 1

Antenna tuning: The antenna UA1DZ is tuned as follow.

- An RF bridge is turned to input terminal of antenna matching device (see **Figure 1**).

- Shift antenna resonance frequencies in amateur 40- and 15-m bands by gradually diminishing the length of matching section A. Five centimeters truncation the length of matching section A does frequency shift up to 200 kHz on 21 MHz, and up to 60 kHz on 7 MHz.

It is quite possible to tune the length of matching section A so, that antenna UA1DZ will have the resonance frequencies inside ranges 21 and 7 MHz. If the antenna UA1DZ has resonances on these ranges (40- and 15-m), it will have a resonance frequency inside 20-m range.

Two-wire opened line: It is possible to use either commercial made two-wire opened line either homebrew one. Remind, that two-wire transmission line with aerial dielectric and 450 Ohm characteristic impedance has relation between the diameter of its wires and the distance between these wires nearly 20 (see **Figure 2**).

RF – choke should be used: An RF-choke should be installed on the coaxial cable at the antenna terminal. This RF-choke precludes leaking of RF currents on the outer braid of the coaxial cable.

Without such RF-choke the outer braid of the coaxial cable will serve as a radiating part of the vertical antenna. It causes big level of RF interferences when the antenna works on transmission. 10 -30 ferrite rings, hardly dressed on the coaxial cable at the antenna terminal, make the most simple an RF-choke. The place for a RF choke is shown in **Figure 1**.

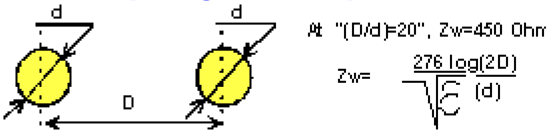


Figure 2

References:

1. RB5IM.: Ground plane UA1DZ. Bulletin UC 1993, C.27.
2. A. Barskiy, VA3TTT: About antenna U www.krasnodar.online.ru/hamradio

Hula- Hoop magnetic Loop

by ***Yuri Kazakevich***, EW6BN, , ew6bn@tut.by

After long QRT (birth of my daughter, changing my QTH) I was going again QRV!!!

So, I needed an antenna! But where can I install it? It was not possible to install any antenna on the roof of my house. I had only place for installation of an antenna, the place was my balcony of my house. Well, it was very place. What an antenna can install at the place? I though, it was only a Magnetic Loop Antenna.

I remembered, when I still went to school, I used a Magnetic Loop Antenna made from old coaxial cable for my work on CB - range 27 MHz. The antenna worked very well. Well, I decided to use a Magnetic Loop Antenna for my very restricted area for a work at 14 MHz.

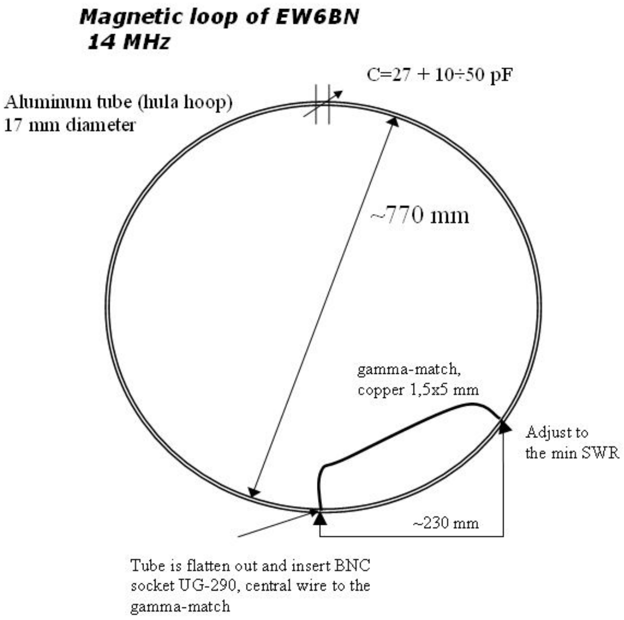
Lots information about Magnetic Loop Antennas I found in the Internet, in particular in reference **[1]**, it is a free e- book on antennas (in Russian).

I decided to make my Magnetic Loop Antenna on the basis of an aluminum hula - hoop. Hula – hoops in diameter of 77 centimeters and with 17 mm tube diameter were on sale in my local shop. The hula – hoop tuned at 14 MHz with two capacitor- one variable capacitor 10- 50 pF, and other, bridged to the variable capacitor, a fixed capacitor in 27 pF. The capacitors placed at the top the hoop. For my loop I used gamma feeding, because it has very high efficiency. **Figure 1** shows my Magnetic Loop Antenna. I have got 1:1.3 SWR with the gamma match.

The Magnetic Loop Antenna was installed on the third floor of a brick five-floor house. A wooden stick hold the antenna almost in one meter aside from the balcony. It was impossible to do a rotary design of the antenna for my conditions, so I just fixed the antenna on the line West – East. My house is situated at outskirts of the city, so, the West is opened, only one imperfection, a high-voltage power electric line on 110 kV is in 50 meters from my antenna….

On reception the antenna worked perfectly. But, unfortunately, there was a small handicap from the high-voltage power electric line.

Figure 1 Magnetic Loop Antenna



The antenna had very good results at transmission mode. See my first QSOs, that I have made straight away after installation of the antenna.

18:50 UTC, 13 July 2003:

I heard "CQ de G3KXV". I pressed on key – "G3KXV de EW6BN/QRP..."
And … "EW6BN/QRP de G3KXV" op Vic.
YES, the QSO is made!
I gave RST 579 QSB.
He gave me 569, also QSB, 100-w and a dipole, your mag loop 77 cm doing very well!

19:25, UTC, 13 July 2003:

HB9DRK/QRP stayed on CQ, he received my call, gave me 329, I gave him the info about my mag loop, and HB9DRK/QRP gave me a new rprt 559, he used 5-w and a delta.

Perfectly... My soul was singing, but I had to do QRT for a while…

So, my balcony Magnetic Loop Antenna allows me to be in the ether again and to do interesting QSOs over the World!

Reference:

1. Igor Grigorov: " Antennas for radio amateurs - 1998, Majkop, e-book,
Available free at http: // cqham.ru/ftp/rk3zk/zip

EW6BN:A Field Operation

A HELICAL LOPP ANTENNA FOR THE 20 METERS BAND

By Vladimir Kuz'min, UA9JKW,
KuzminVI@pn.yungjsc.com

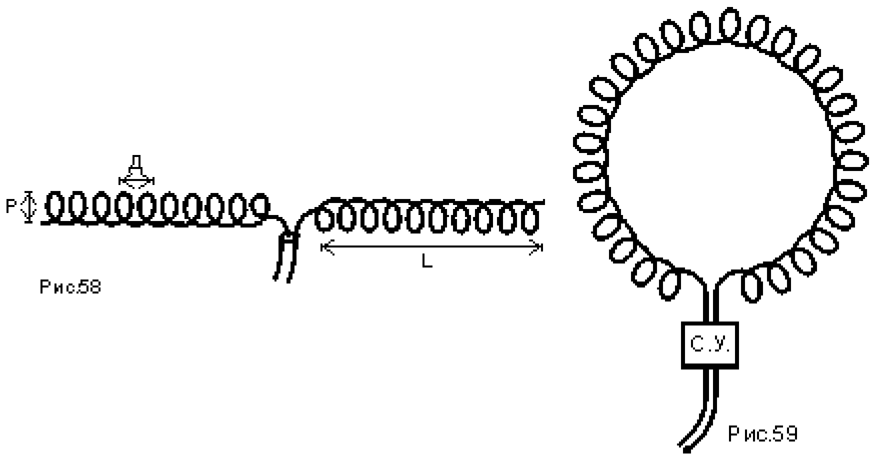
Two years back I have moved to Nefteyugansk (Russia, Siberia) where I could not receive the sanction to installation for a full-sized HF- antenna on the roof of my house. , So I began to do experimenters with short indoors antennas. Most success design of my indoor antenna is a design similar to ***Fig. 59****, given in* ***Reference 1****.*

I have used an inch OD plastic pipe to the form of the antennal. The pipe was bent in a hoop near1 meter diameter. Antenna has 580 turns (near 61 meters of length) of multicore isolated wire of 3 mm diameter with thickness of isolation of 1 mm. So, the spacing between turns is 2 mm. Antenna has SWR 1:1 to 50-Ohm coaxial cable to 14.100, bandwidth to SWR 1:1.5 is 300-kHz. I use a simple symmetrical device- 3 turns on a TV yoke ferrite core. Space from the antenna to the ceil is near 25 centimeters.

The antenna has quite good directed properties at rotation within 30-90 degrees the force of signals varied to 1-1,5 points on mine S-meter. I use a YAESU FT840 for my work in the ether. Change of polarization (at rotation of the antenna on the vertical side) appreciable changes has not given as well as change of feeding points has not given large change in the force of signals.

Helical Loop Antenna

Figure 58 & 59 from Reference 1



In the last summer I experimented and hung up of the antenna behind my balcony at 1.5 meters from a wall. I have received a significant improvement of the work of the antenna The antenna does very good operation in the ether, better than others indoors antennas. It gives low industrial noise and kills all TVI.

Reference:
I. Grigorov. Antennas for radio amateurs. - Majkop, 1998.

Get free the book from

http://www.cqham.ru/

UA9JKW at his shack

Top Load at Vertical Antennas

All amateurs know if at a vertical antenna a top load it is used, the self –resonance of the vertical antenna would be lower then a vertical without the top load. How a top load does influence to antenna resonance?

At **Reference 1** I found a very interesting table having the data. I have proved the table with **MMANA**, all okey, the table gives very reliable data, so it is possible to use it at many situations. Figure 1 shows different top loads. Data for loaded effect for the top load is shown in Table 1 given at **Reference 1**. K is coefficient: K = W/L, where W is a resonance wavelength for the vertical antenna, L is antenna length from the ground to the top load.

As it is seen, the "umbrella" top load (**Figure 1e**) gives the most effect on the resonance of a vertical antenna. For example, if to use an umbrella load for a vertical antenna in five meters height, the antenna quarter wave fundamental resonance wavelength would be changed from 20 to 50 meters!

Reference:

1. Polyakov V. Technique of radio: Simple AM receivers. – Moscow, DMK-Press, 2001.

73! I.G.

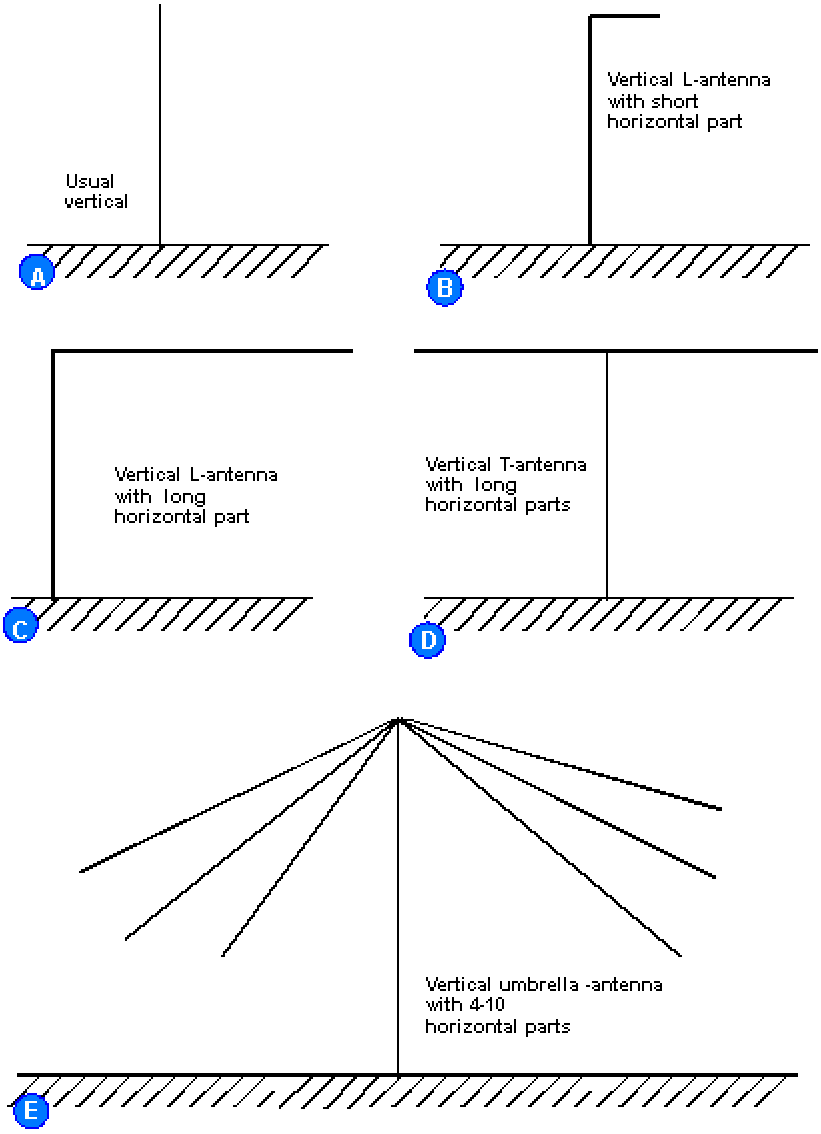


Figure 1

Kind of an antenna	K
Simple vertical **Figure 1a**	4
Inverted L with short horizontal part **Figure 1b**	4.5-5
Inverted L with long horizontal part **Figure 1c**	5-6
T- antenna with long horizontal part **Figure 1d**	6-8
Umbrella antenna with 4-8 wires **Figure 1e**	6-10

Three Band Universal RZ3AE Antenna

Evgeniy, RZ3AE

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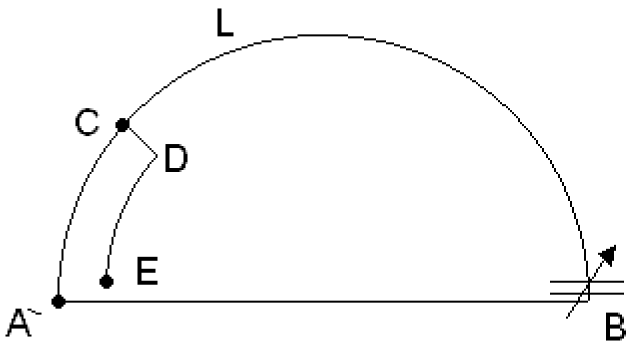
For several years I use to a simple and rather effective home – made antenna for a work from my balcony, a hotel window, from the ground in a radio- expedition and from my car. I with my friends have made a dozen such antennas and all the antennas work very well. One antenna, in depend of its dimension, works at three old amateur ranges- 10, 15,20 or 15, 20,40, or 20,40, 80.

Antenna description:

Figure 1 shows the antenna. Antenna wire is a tube or copper or bimetal rod of 5-12-mm diameter (#0000—5 AWG). D-E wire is thinner then a-c-b wire in 2-5 times. Antenna is tuned by air (a vacuum capacitor is better!) variable capacitor with air-gap in 2-mm. The capacity is 5- 750-pF.

Figure 1 RZ3AE Antenna



Antenna ratio:

L = 1.57AB

CD = 5-8 centimeters

AC ≈ 0.2L

Most high frequency for the antenna is: 4 (AB+L).

Antenna adjustment

To run a QRP power at most high frequency for the antenna. Move a crosspiece CD to find the minimum SWR. Check position of the crosspiece. To run a QRP power for next working band of the antenna. Move a crosspiece CD to find the minimum SWR. Check position of the crosspiece. And so on.

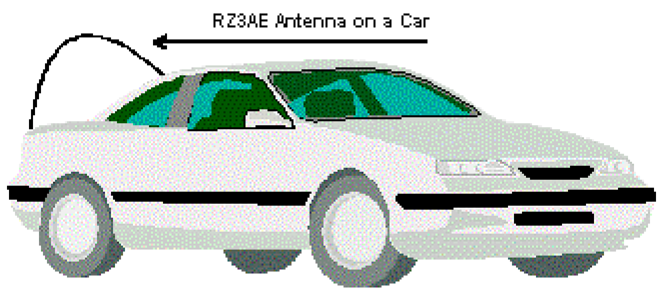
Antenna operation

To stand the crosspiece by manually or by RF-relays for choosing band. The antenna has very high directivity, so, choose needed position for the antenna. Switch your transceiver and enjoy!

Antenna results

I tried the antenna at different conditions and everywhere the antenna works well, from my house, from my car (the antenna is placed at boot of my car), from a field. I use to the antenna with IC-706 MK2G.

I wish all good luck! 73!



Fast Made a Half - Wave Antenna for 80 Meters

By Igor Grigorov, RK3ZK

G-QRP-C 6363

The antenna was made by me in one of the hot summer days near five years back. I was going for weekend to my bungalow and I decided to take my home- brew 80 – meters transceiver with myself. I had no antenna for the transceiver. So, I needed to do any antenna, but I had no time as no quality stuff for doing this one. I opened my box with old tips… and… Thirty minutes while I have had a new antenna that served me several years!

Figure 1 shows the all antenna system. I have done a half wave antenna with “bottle” matching device. As you can see a wire in long of 40 meters (a half wave antenna) is matched with 50-Ohm output of my transceiver with help of a parallel circuit (“bottle” matching device) – it is L1C1 in **Figure 1**. Spool L2 has not electrical connection with antenna circuit. RF energy is transferred from antenna to the spool only by magnetic field, that reduces the level of static interferences at receiving mode. The counterpoise has length of 20 meters of a naked copper wire in diameter of 1,5 millimeters (#14 AWG). I used a wire from an old burned down electrical transformer 220-V/12-V. The counterpoise serves as electrotechnical both as radio ground for the antenna. At operation time of the antenna the counterpoise is placed on the ground in any position (straight or bending). To short static electrical charge from antenna wire to ground is main task of the counterpoise. Not wise to use a long antenna in field without an electrotechnical ground, because in the first it is unsafe, and in the second, the antenna is very rustle on reception without an electrotechnical ground.

Figure 2 shows the construction of the matching device. I used a half - liter plastic bottle in diameter 60 millimeters from mineral water. C1 is attached at a side of the bottle with help of a strong copper wire in diameter of 1 millimeter (#18 AWG). L1 has 15 turns of copper wire in diameter of 1,5 millimeters (# 14 AWG), length of winding is 70 millimeters.

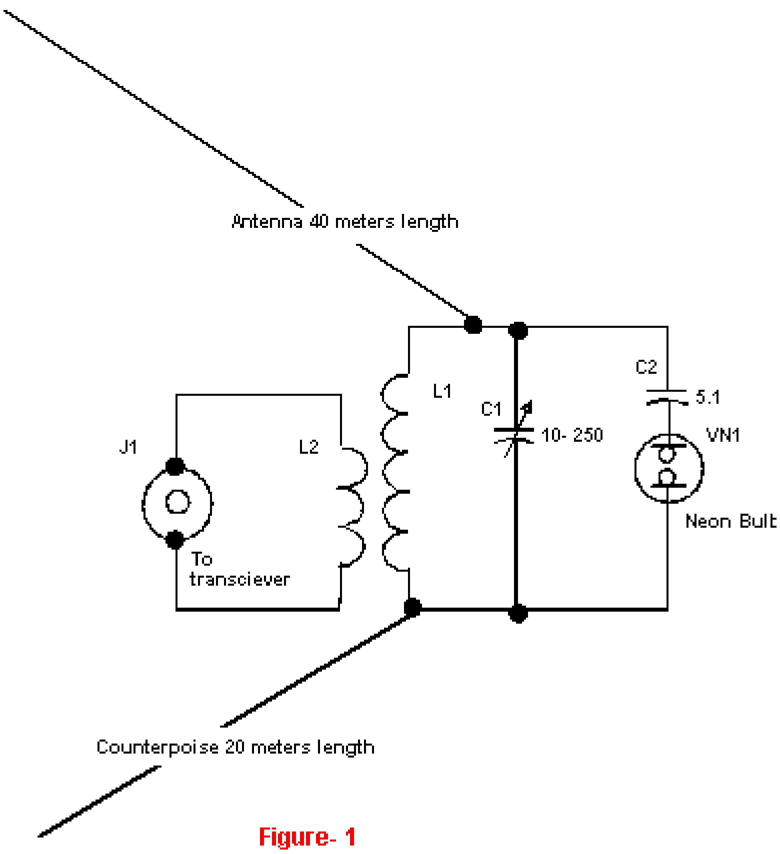


Figure- 1

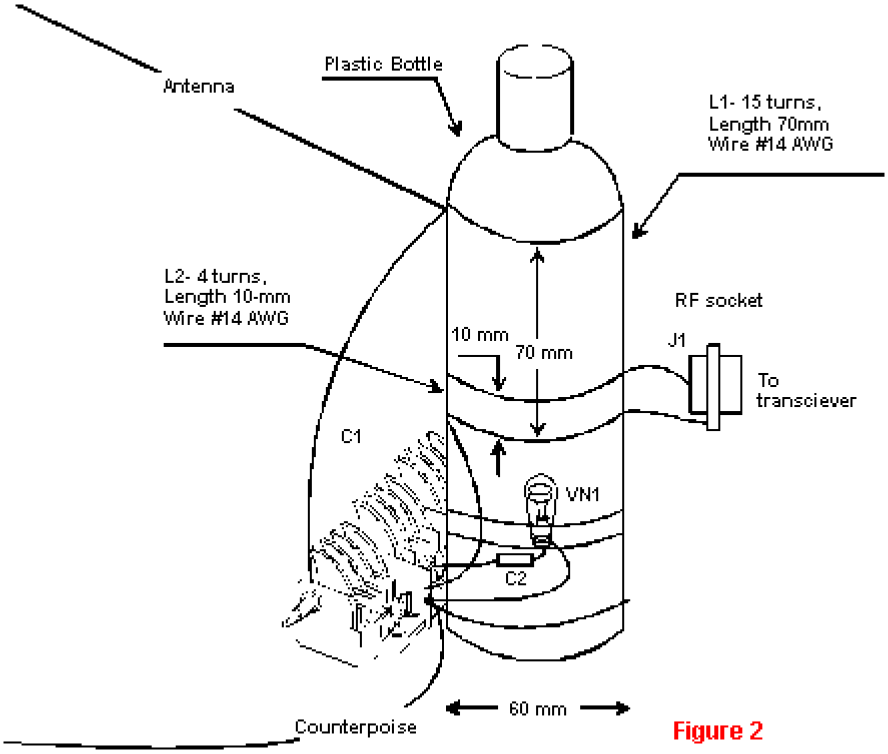


Figure 2

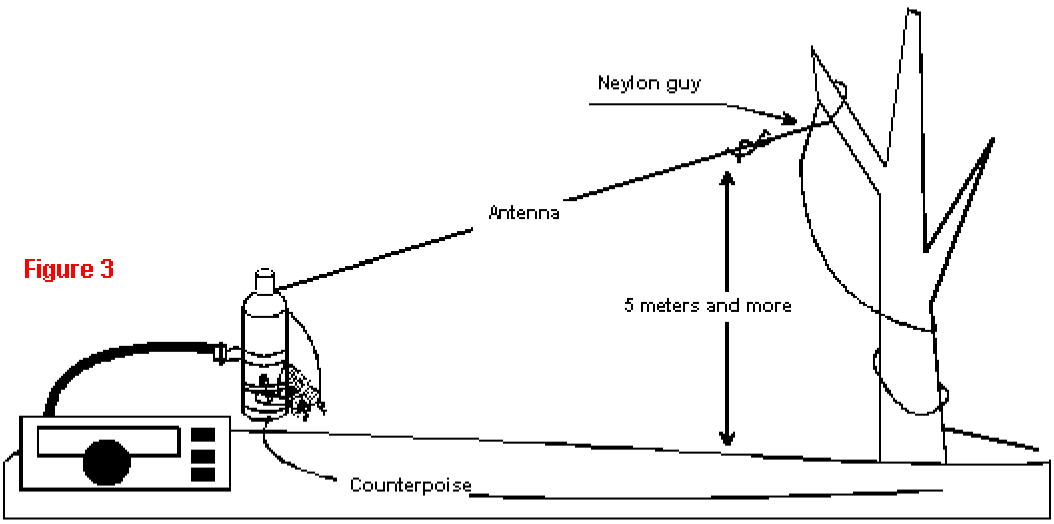
L2 is placed at the bottom of L1. L2 contains 4 turns of copper wire in diameter of 1,5 millimeters (# 14 AWG), length of winding is 10 millimeters. Ends of L2 are directly soldered to J1 RF – socket. VN1 is attached by a piece of Scotch to the bottle. Antenna is tuned by max glow of VN1.

The antenna works very effectively when the upper end of the antenna at lengths of five or more meters above the ground. I don't use an end antenna insulator. A long synthetic rope can simply be attached to the upper end of the antenna. The down end of the antenna could be just near the ground. A coaxial cable having any reasonable length can be between "bottle" ATU and a ham transceiver. **Figure 3** shows the antenna at field operation. Of course, it is very possible to use the antenna for stationary work from a ham shack.

The antenna works very well, and I recommend try it!

73/72!

Figure 3



WINDOW DIPOLE ANTENNAS WITH CAPACITIVE LOADS FOR THE 6 AND 10 METERS BANDS

by Igor Grigorov, VA3ZNW
mailto: antentop@antentop.org

It is possible to install a dipole antenna with capacitive loads for the 6 and 10 meters bands at a standard window with sizes 140x150 or 140x210 centimeters. The design of that window antenna for the bands can be simple as well as the antenna impedance can be easy matched with 50-Ohm coaxial cable. That dipole antenna with capacitive loads installed at upper floor of a high-rise building can provide DX- QSOs.

However, a dipole window antenna with capacitive loads for bands low the 10-meters, if this one is installed at a standard window with sizes 140x150 or 140x210 centimeters, has low input impedance and narrow bandwidth so the antenna is hard to match. Hence antennas for bands low the 10 meters are not discussed in this article.

Types of a Dipole Antenna with Capacitive Loads

There is several ways to install a dipole antenna with capacitive loads at a window. The best way is to install a dipole antenna with capacitive loads by the center of the window. In that case the antenna can be installed at any house as made from a brick or wood as well as made from a concrete. Let's name the antenna "antenna central installation." If a house made of a brick or wood it is possible to install the dipole antenna with capacitive loads by up or down of the window. Let's name the antenna "antenna up or down installation." Of course, a non metal window-frame works better the metal one.

Feeding Coaxial Cable of a Dipole Antenna with Capacitive Loads

Ferrite rings (5- 20 ring with any permeability) installed at two ends of the coaxial cable going from TX to the antenna prevent RF- currents going from the antenna to TX. Since the rings do balun's job. Fasten the rings at the coax with a Scotch. The coaxial cable going from the antenna to the window-sill should be placed athwart to the antenna. However the coaxial can be placed as you want at you room.

Stuff for a Dipole Antenna with Capacitive Loads

A dipole antenna with capacitive loads can be made of a flexible multi- wire cable as well as of a strand wire. Any wire is good as naked as well covered by plastic isolation. Diameter of the wire can be near 1- 2 millimeters (12- 18 AWG). Use wire as much thick as possible. Compare to antenna made from thin wire thick antenna has wider bandwidth. It is wise (because it is cheap) to do a dipole antenna with capacitive loads without ends insulators. The antenna can be installed with help of a rope or plastic (as well as fishing) cord. A dipole antenna with capacitive loads of up or down installation can be installed directly (with help of nail or staple) at plastic or wooden window frame.

Window Dipole Antennas with Capacitive Loads for 6-meters Band

Figure 1 shows a schematic (**Figure 1a**) and design (**Figure 1b**) of a window dipole antenna with capacitive loads of central installation. **Figure 2** shows a schematic of a window dipole antenna with capacitive loads of up or down installation. The design of the antenna is similar to design shown at **Figure 1b**. The design of the both antennas is simple. Two ropes are installed at two ends of the window. Capacitive loads fastened to the ropes by thin wires or ropes. Third rope is installed at the center of the window. Antenna central insulator (made from a piece of any plastic or PC board) is fastened to the rope.

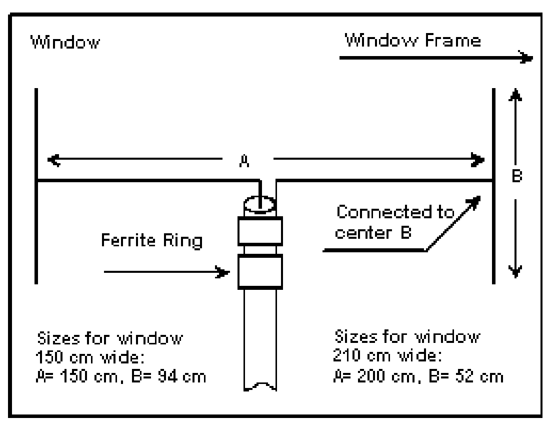


Figure 1A

Figure 1 A window dipole antenna with capacitive loads of central installation

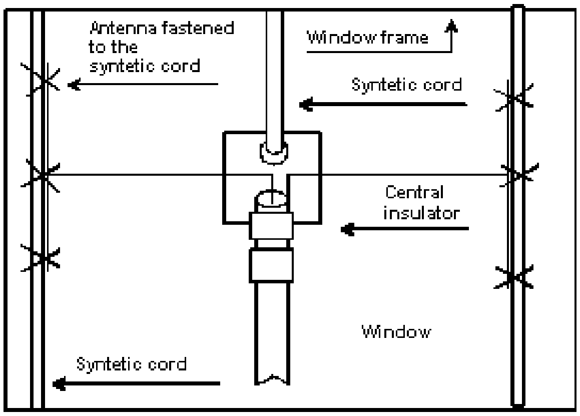


Figure 1 A window dipole antenna with capacitive loads of central installation

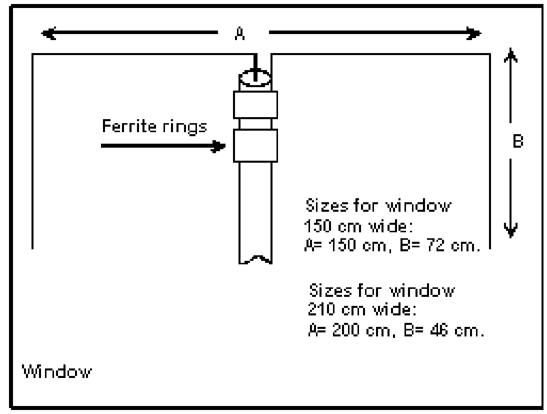


Figure 2 A window dipole antenna with capacitive loads of up or down installation

Adjustment of the both antennas is simple. A SWR-meter or HF- bridge (see References **[1]**) is connected to feed points of the tuned antenna. Gradually shorten 'moustaches' (symmetrically each moustache) of the antenna to minimum SWR or when antenna input impedance is active (has no reactive component) at needed frequency. At shortening moustaches the moustache wires roll up to a little coil.

Parameters of the Window Dipole Antenna with Capacitive Loads of Central Installation

Theoretical parameters of the antennas (copper, wire in 1-mm (18- AWG) diameter) were simulated with help of MMANA (see References **[2]**).

Figure 3 shows the input impedance of the antenna installed at window 150-cm wide. **Figure 4** shows the input impedance of the antenna installed at window 210-cm wide. Theoretical input impedance for 'narrow' antenna is 42-Ohms, for 'wide' antenna is 60- Ohms. The data are very good matched with my practical measurement of the antennas. A 50- Ohm coaxial cable should be used for feeding of the antennas. This one can be connected directly to antenna feed points, as it is shown at **Figure 1**. A 75-Ohm coaxial cable is possible to use for the antenna installed at wide (210 cm) window. **Figure 5** shows a SWR at 50- Ohm coaxial for 'narrow' antenna shown at **Figure 1**. **Figure 6** shows a SWR at 50- Ohm coaxial for 'wide' antenna shown at **Figure 1**. Theoretical gain for the antennas is near 1,5- 1,7 dBi.

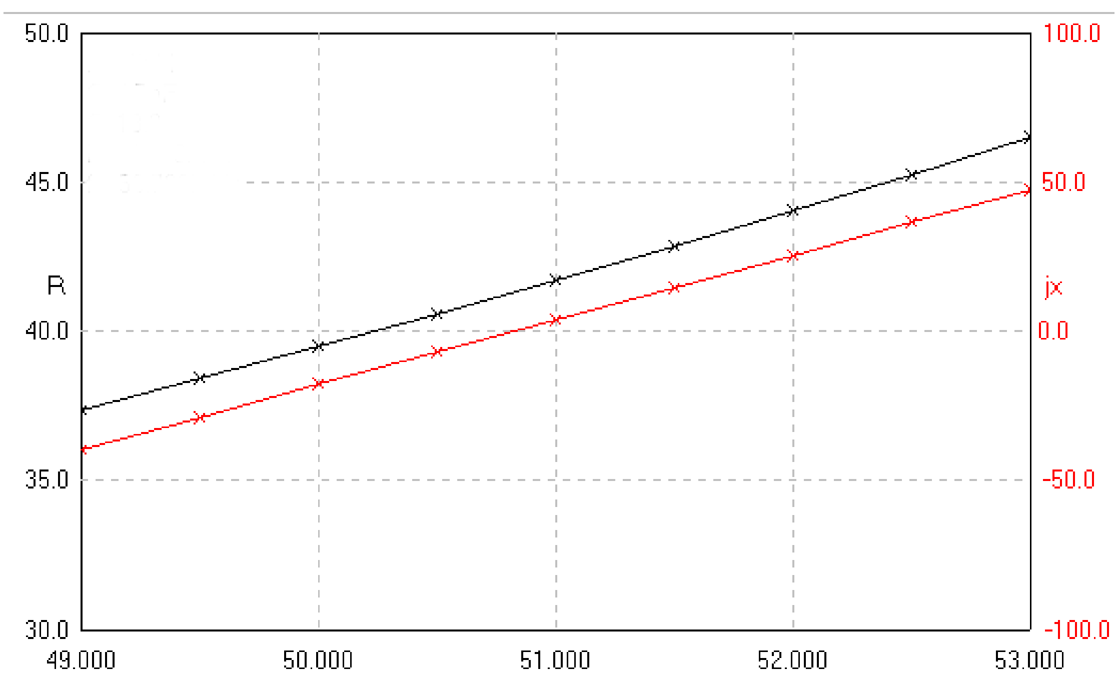


Figure 3 Input impedance of 'narrow' antenna

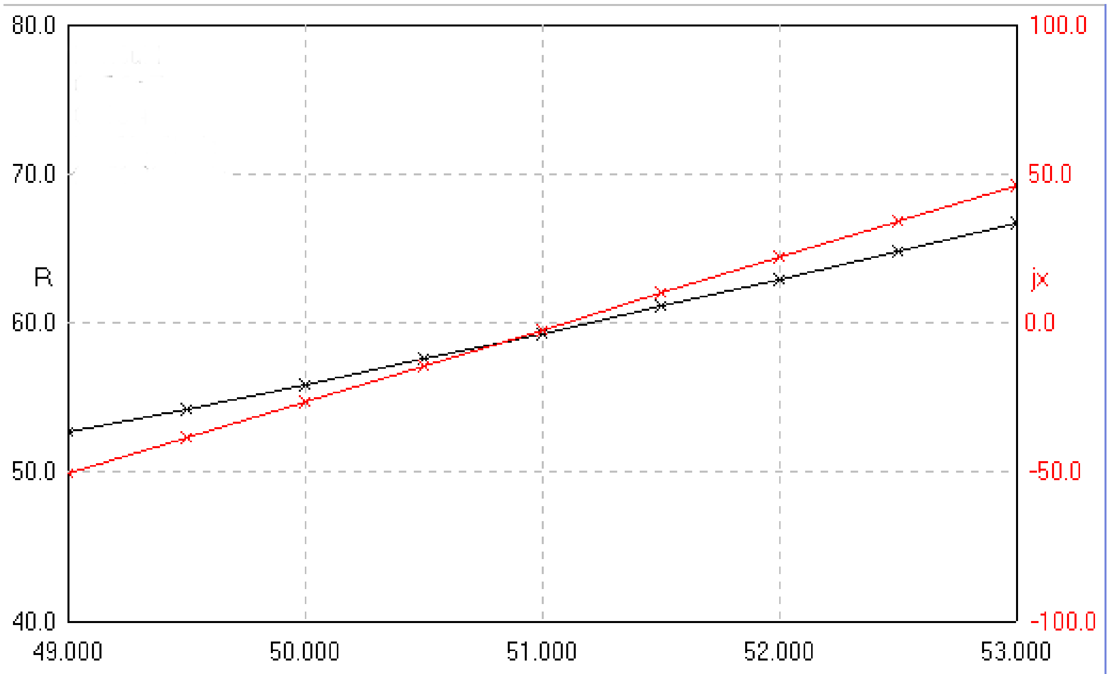


Figure 4 Input impedance of ‘wide’ antenna

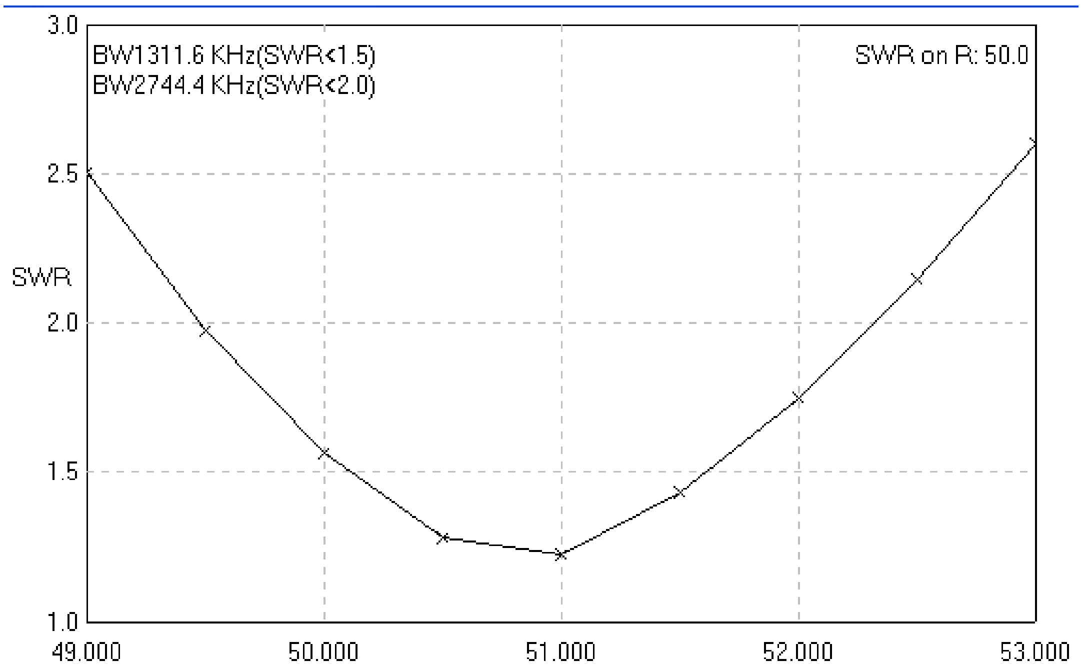


Figure 5 SWR at 50- Ohm coaxial for ‘narrow’ antenna

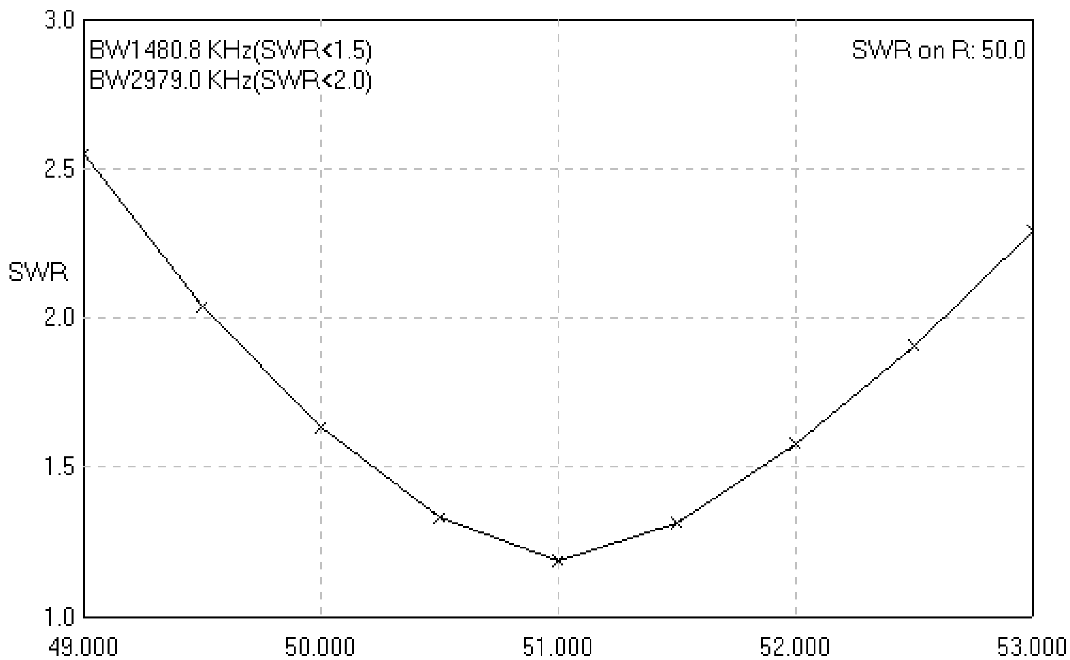


Figure 6 SWR at 50- Ohm coaxial for 'wide' antenna

A 'narrow' antenna of central installation has theoretical pass band 1300 kHz at SWR 1,5:1 at 50- Ohm coaxial cable, and pass band 2744 kHz at SWR 2:1 at 50- Ohm coaxial cable. A 'wide' antenna of central installation has theoretical pass band 1480 kHz at SWR 1,5:1 at 50- Ohm coaxial cable, and pass band 2979 kHz at SWR 2:1 at 50- Ohm coaxial cable. It is quite enough for working at 6- meters band especially since the real antenna has pass band wider the theoretical.

Parameters of the 6- meters Band Window Dipole Antenna with Capacitive Loads of Up and Bottom Installation

Theoretical parameters of the antennas (copper, wire in 1-mm (18- AWG) diameter) were simulated with the help of MMANA. **Figure 7** shows input impedance of the antenna installed at window 150 cm wide. **Figure 8** shows input impedance of the antenna installed at window 210 cm wide. Theoretical input impedance for 'narrow' antenna is 43- Ohms, for 'wide' antenna- 60- Ohms. The data are very good matched with my practical measurement of the antennas.

A 50- Ohm coaxial cable should be used for feeding of the antennas. This one can be connected directly to antenna feed points, as it is shown at **Figure 2**. A 75- Ohm coaxial cable is possible to use for an antenna installed at wide (210 cm) window.

Figure 9 shows a SWR at 50- Ohm coaxial for 'narrow' antenna shown at **Figure 2**. **Figure 10** shows a SWR at 50- Ohm coaxial for 'wide' antenna shown at **Figure 2**. Theoretical gain for the antennas is near 1,5- 1,7 dBi.

A 'narrow' antenna with capacitive loads of up or down installation has theoretical pass band 1377 kHz at SWR 1,5:1 at 50- Ohm coaxial cable, and pass band 2697 kHz at SWR 2:1 at 50- Ohm coaxial cable. A 'wide' antenna with capacitive loads of central installation has theoretical pass band 1393 kHz at SWR 1,5:1 at 50- Ohm coaxial cable, and pass band 2876 kHz at SWR 2:1 at 50- Ohm coaxial cable. It is quite enough for working at 6- meters band especially since the real antenna has pass band wider the theoretical.

Window Dipole Antennas with Capacitive Loads for 10-meters Band

Figure 11 shows schematic a window dipole antenna with capacitive loads of central installation. **Figure 12** shows schematic a window dipole antenna with capacitive loads of up or down installation. Antenna central installation can be installed at window 210-cm wide. Antenna up or down installation can be installed at window 150 or 210-cm wide.

The design of the both antennas is similar to design shown at **Figure 1b**. Two ropes are installed at two ends of the window. Capacitive loads fastened to the ropes by thin wires or ropes. Diagonal capacitive loads are spread by thin ropes. Third rope is installed at the center of the window. Antenna central insulator (made from a piece of any plastic or PC board) is fastened to the rope.

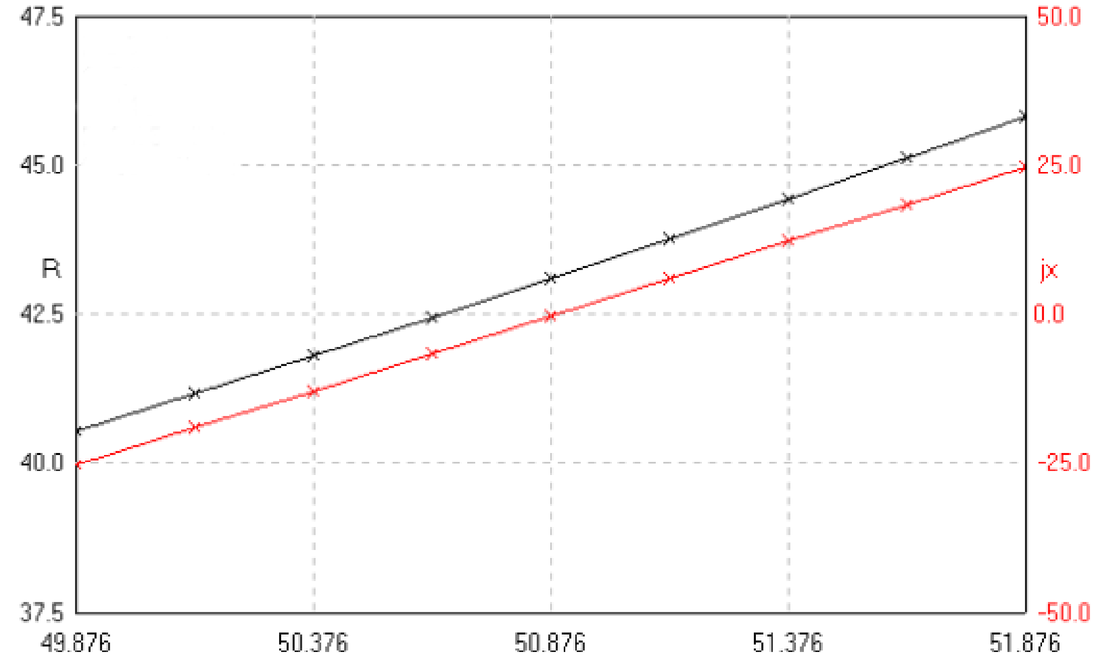


Figure 7 Input impedance of 'narrow' antenna

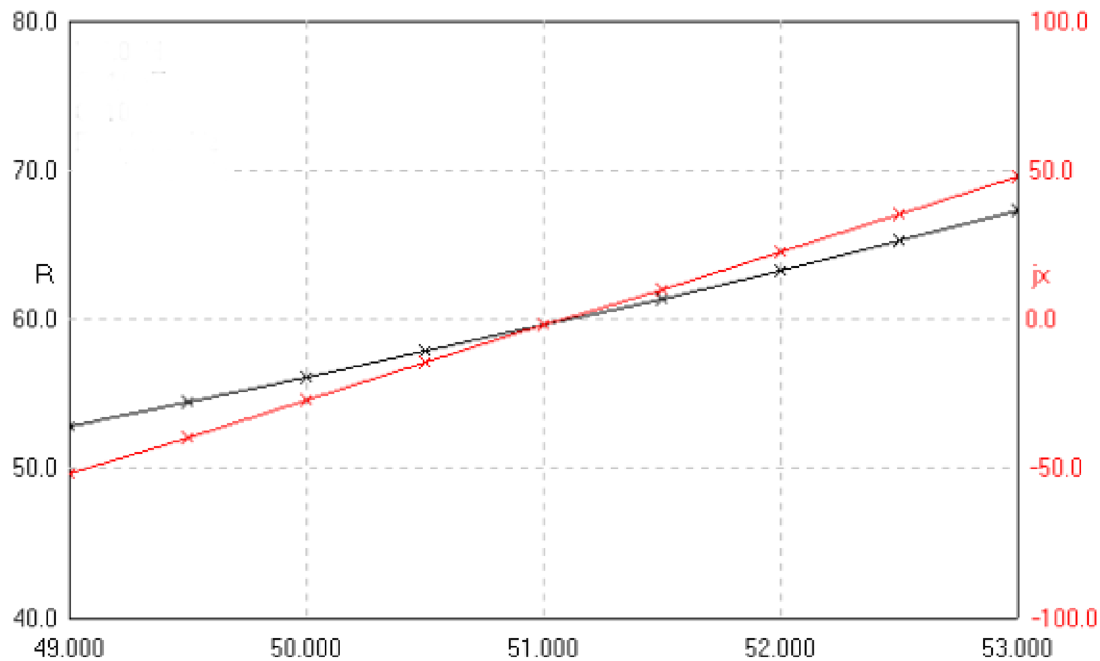


Figure 8 Input impedance of 'wide' antenna

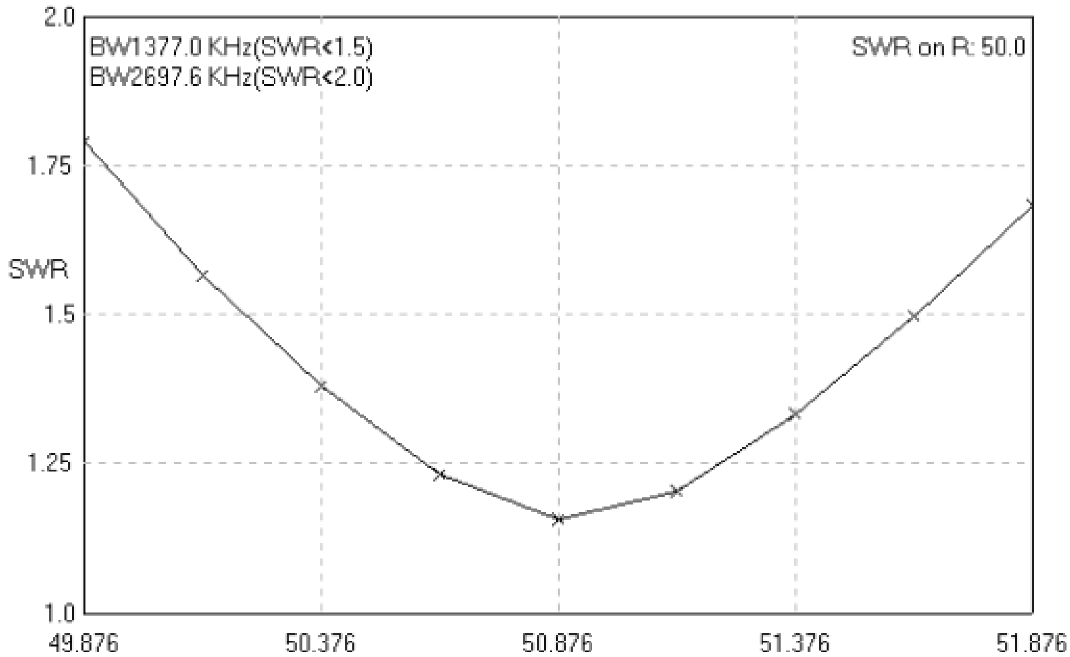


Figure 9 SWR at 50- Ohm coaxial for 'narrow' antenna

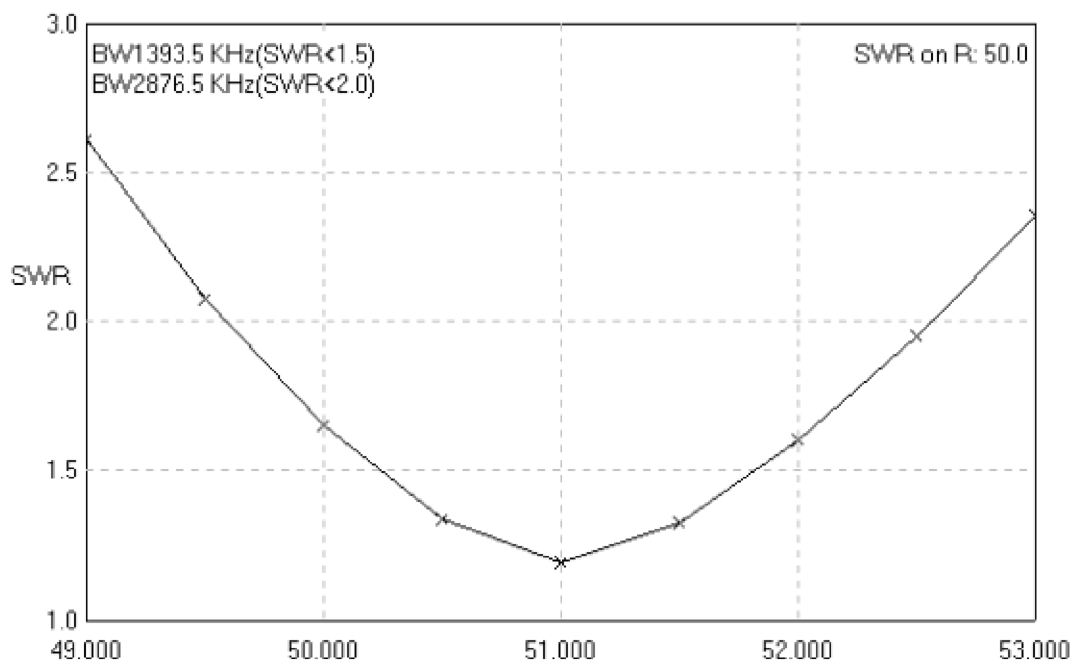


Figure 10 SWR at 50- Ohm coaxial for 'wide' antenna

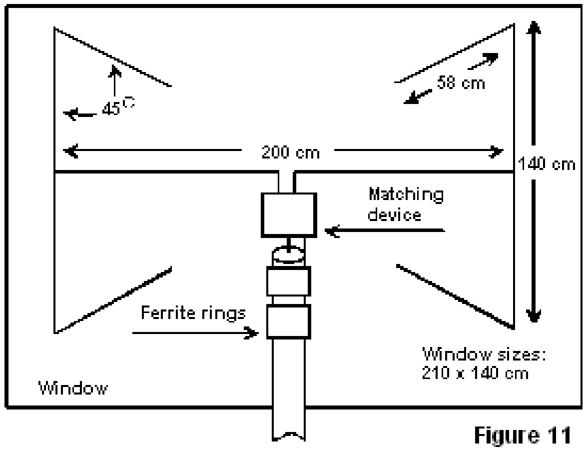


Figure 11 A window dipole antenna with capacitive loads of central installation

Adjustment of the both antennas is simple. A SWR-meter or HF- bridge (see References [1]) is connected to feed points of the tuned antenna. Gradually shorten moustaches (symmetrically each moustache) of the antenna to minimum SWR or when antenna input impedance is just active (have no reactance) at needed frequency. At shortening moustaches the moustache wires roll up to a little coil.

Input Impedance of 10-meters Band Window Dipole Antennas with Capacitive Loads

Theoretical parameters of the antennas (copper, wire in 1-mm (18- AWG) diameter) were simulated with the help of MMANA. **Figure 13** shows input impedance of the antenna shown in **Figure 11**. Theoretical input impedance of the antenna is 22- Ohms. Practically measured input impedance of the antenna was 30- Ohms. Losses in neighbor objects add the 8 Ohms. Theoretical gain for the antennas is near 1,5- 1,7 dBi.

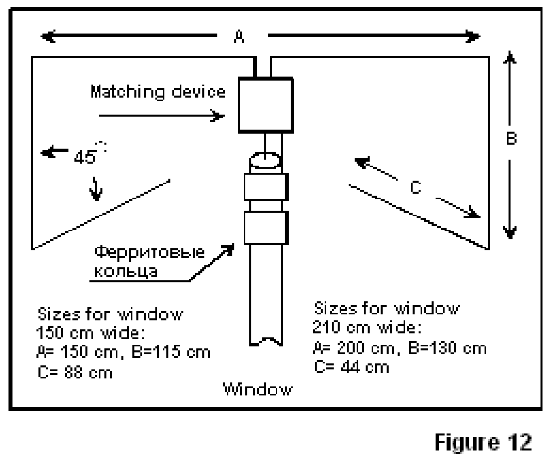


Figure 12 A window dipole antenna with capacitive loads of up or down installation

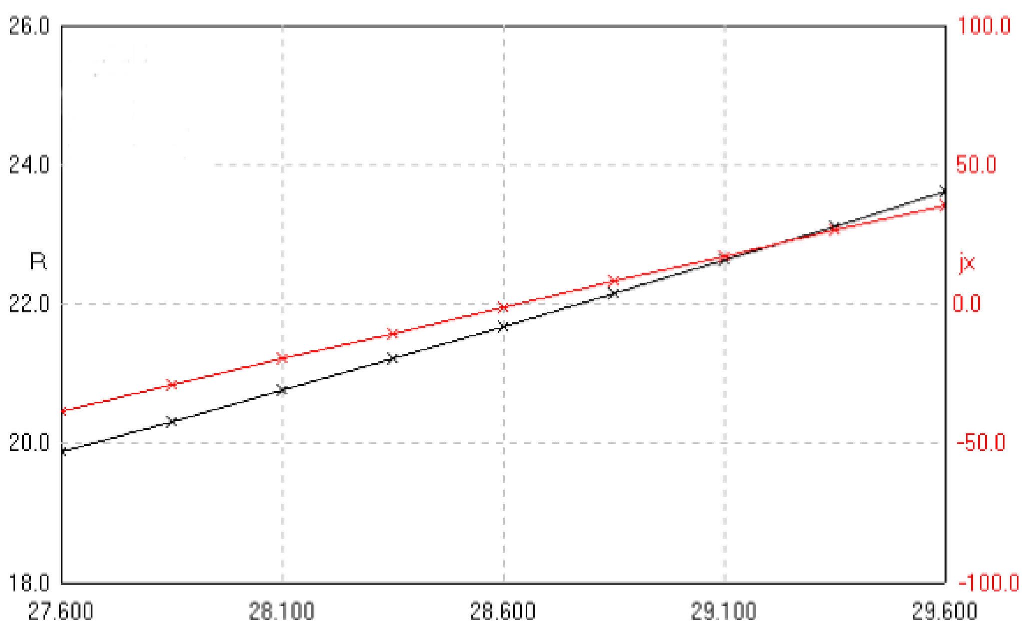


Figure 13 Input impedance of the antenna shown in **Figure 11**

Feeding of 10-meters Band Window Dipole Antennas with Capacitive Loads

Since 10- meters band window dipole antenna with capacitive loads has low input impedance a matching device must be installed between the antenna and feeding coaxial cable.

MMANA allows to simulate such matching device. **Figure 14** shows schematic of that matching device as well as data for different antennas. Of course, it needs adjust a little the L and C to particular antenna.

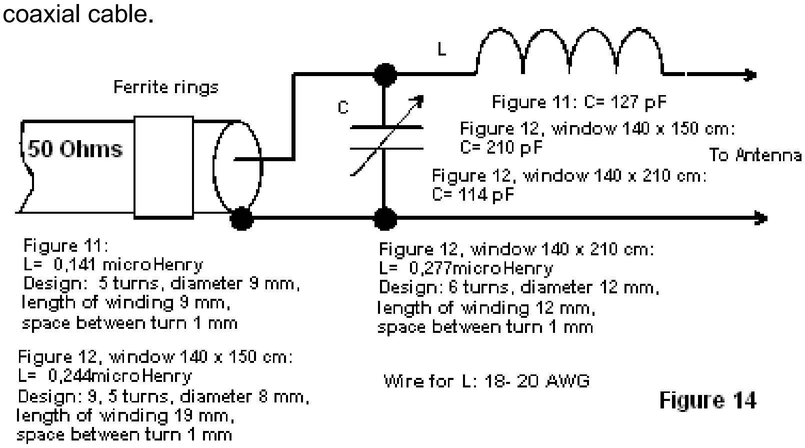


Figure 14 Matching device for antenna with capacitive loads

SWR of 10 – meters Band Window Dipole Antennas with Capacitive Loads

Figure 15 shows a SWR at 50- Ohm coaxial connected through a matching device (see **Figure 14**) to antenna shown at **Figure 11**. SWR was simulated by MMANA.

The antenna has theoretical pass band 375 kHz at SWR 1,5:1 at 50- Ohm coaxial cable, and pass band 750 kHz at SWR 2:1 at 50- Ohm coaxial cable. It is not enough for working at all 10- meters band. However, due the losses at neighbor subjects the pass band of the antenna is wider the theoretical one.

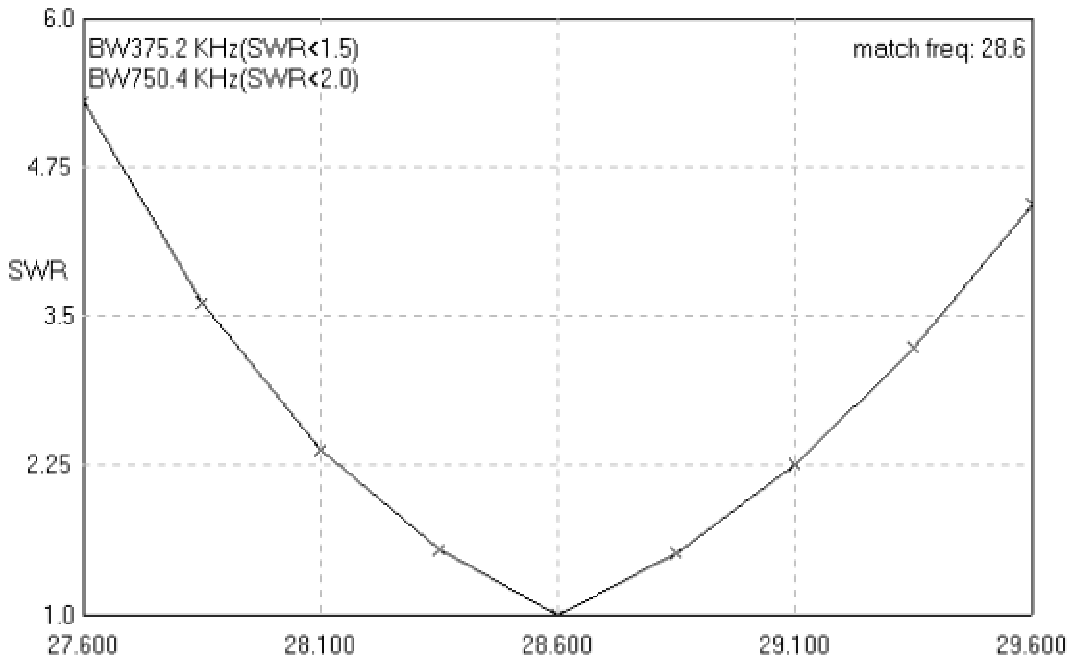


Figure 15 SWR at 50- Ohm coaxial connected through a matching device (see **Figure 14**) to antenna shown at **Figure 11**

Parameters of the 10- meters Band Window Dipole Antenna with Capacitive Loads of Up and Bottom Installation

Theoretical parameters of the antennas (copper, wire in 1-mm (18- AWG) diameter) (see **Figure 12**) were simulated with help of MMANA. **Figure 16** shows input impedance of the antenna installed at window 150 cm wide.

Figure 17 shows input impedance of the antenna installed at window 210 cm wide. Theoretical input impedance for 'narrow' antenna is 12- Ohms, for 'wide' antenna- 26- Ohms. Practically measured impedance is higher on 8- 10 Ohms the theoretical due losses at neighbor subjects. **Figure 18** shows a SWR at 50- Ohm coaxial connected through matching device (see **Figure 14**) to 'narrow' antenna (see **Figure 12**).

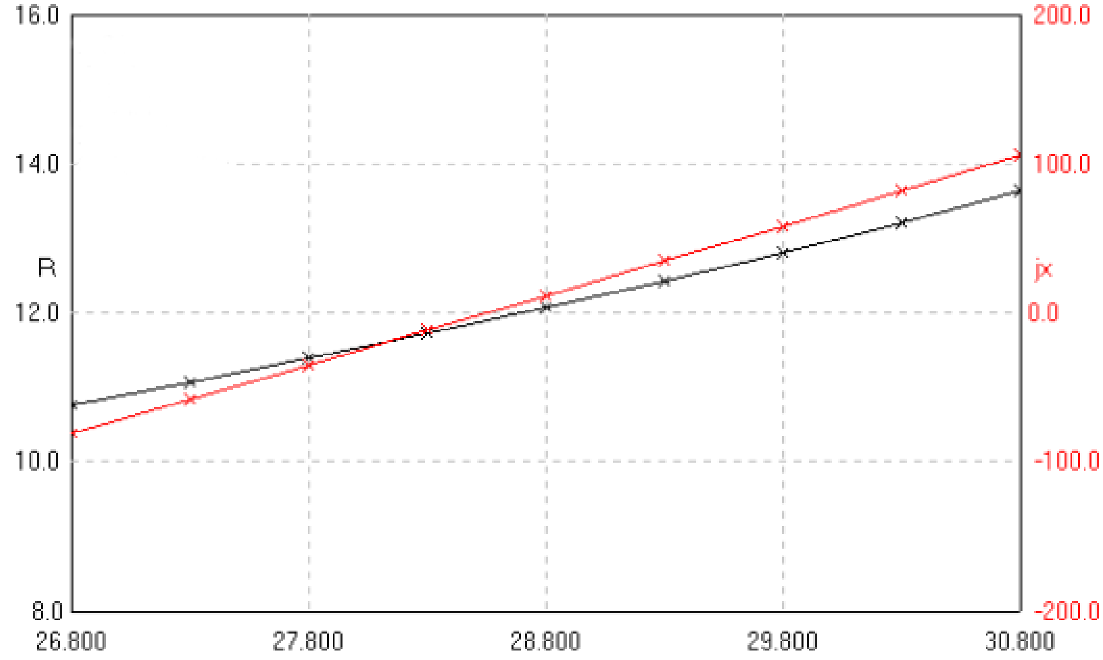


Figure 16 Input impedance of the antenna installed at window 150-cm wide

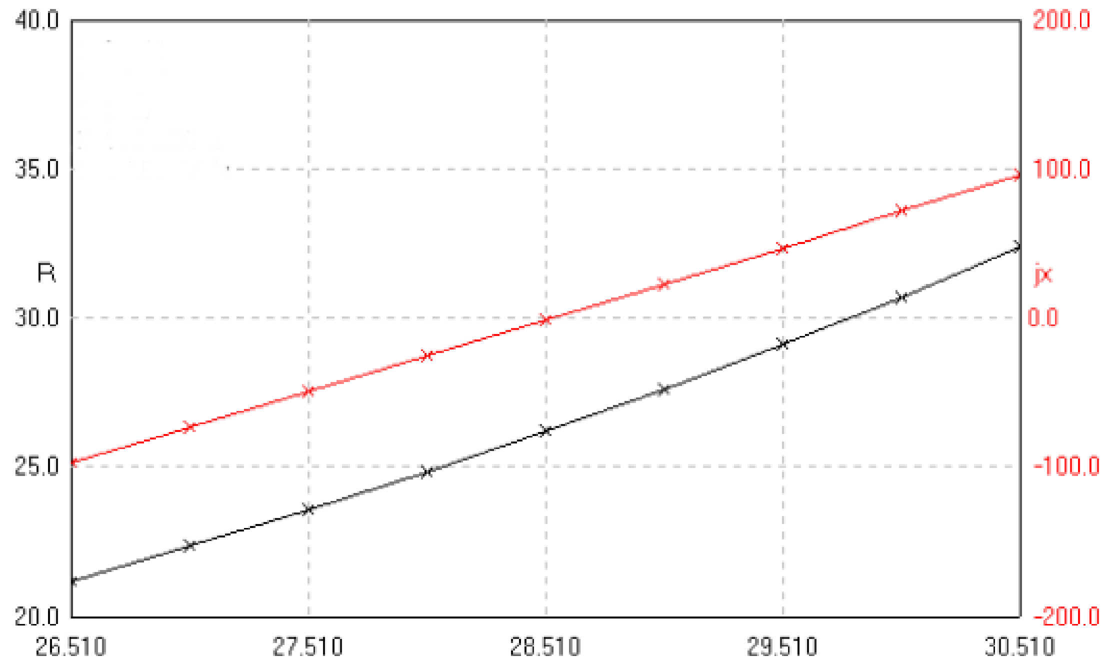


Figure 17 Input impedance of the antenna installed at window 210-cm wide

Figure 19 shows a SWR at 50- Ohm coaxial connected through matching device (see **Figure 14**) to 'wide' antenna (see **Figure 12**). SWR was simulated by MMANA. Theoretical gain for the antennas is near 1,1-1,3 dBi

A 'narrow' antenna with capacitive loads of up or down installation has theoretical pass band 157 kHz at SWR 1,5:1 at 50- Ohm coaxial cable, and pass band 314 kHz at SWR 2:1 at 50- Ohm coaxial cable. A 'wide' antenna has theoretical pass band 425 kHz at SWR 1,5:1 at 50- Ohm coaxial cable, and pass band 733 kHz at SWR 2:1 at 50- Ohm coaxial cable.

So those antennas can work only at a part of the 10 meters band. For working at all 10- meters band matching device can be retuned for needed frequency. However, the 'wide' antenna often works at all 10 meters band without retuning the matching device due losses at neighbor subjects.

References:

1. Igor Grigorov. Antennas. Matching and Adjustment. – Moscow. RadioSoft, 2002. ISBN 5-93037- 087-7

2. http://dl2kq.de/

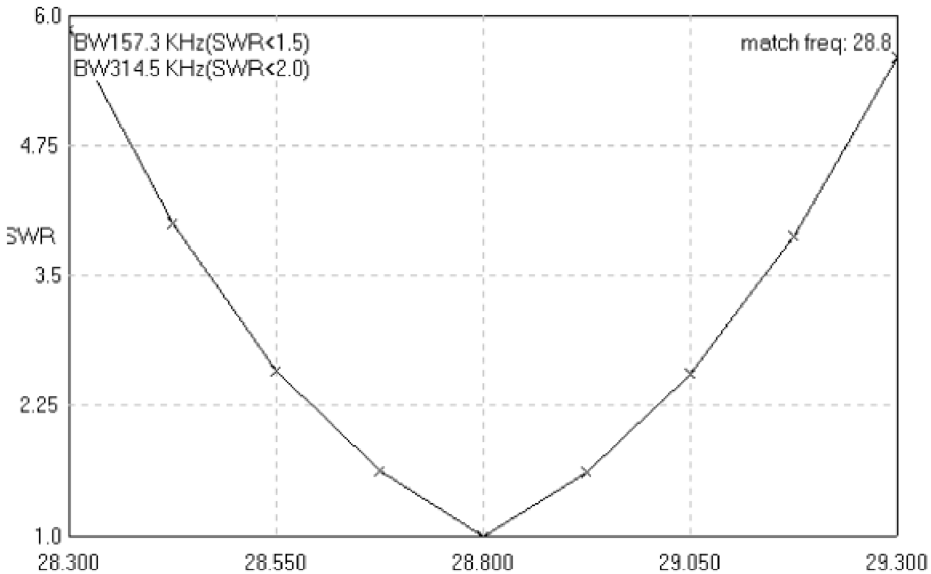


Figure 18 SWR at 50- Ohm coaxial connected through matching device to 'narrow' antenna

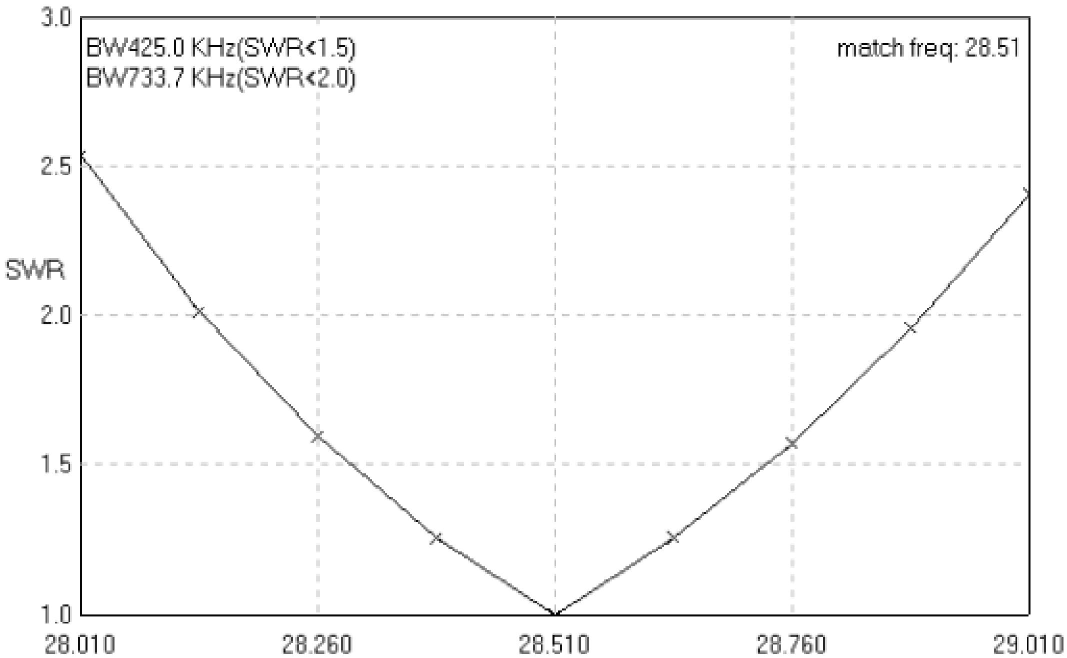


Figure 19 SWR at 50- Ohm coaxial connected through matching device to 'wide' antenna

J- Antenna for 160, 15 and 10(FM) meters
Unusual Look to Usual Things

by Valentin Gvozdev , RU3AEP, http://www.vgvozdev.narod.ru/
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Introduction

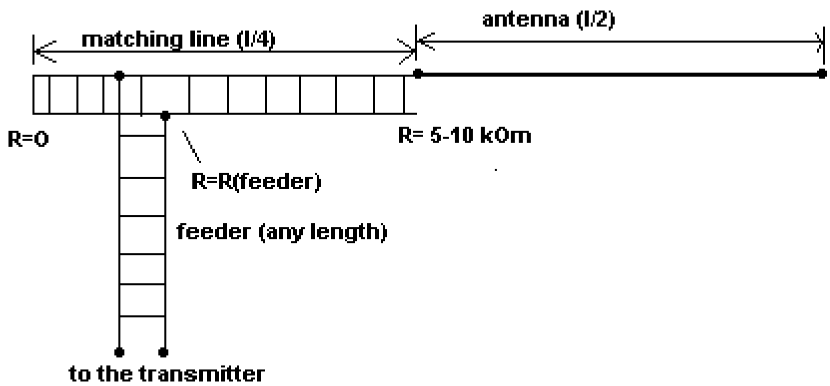
After getting my first amateur license I had to think, what antenna to build for a top-band (160 m), I realized, that conditions are too bad for it. I live in a 7-floor house, which has a roof with a high slope (about 35-40 degrees), which is very dangerous to operate on it. Also, the house is almost completely surrounded by wide streets and electrical wires going along them. After long thinking, I concluded, that there is only one possibility to make an antenna - to hang up a long wire from my roof to the roof of another house. Unfortunately, any dipole-type antenna was unacceptable, because in this case my apartment would have been too far away from the feed point of the antenna, and the condition of right angle (90°) between feeder and antenna itself could not be satisfied. Fortunately, in that time I have read about one very old, but not frequently used antenna - so called Zeppelin-antenna with a matched feeding.

Classical design with an opened line

Actually, this is shortly described in well-known book ("Antennenbuch"), written by DM2ABK (Karl Rothammel), but has been recently developed by Sergey Makarkin (RX3AKT), a radioamateur from Moscow, who has published a good article in "Radio-Design" journal (N2, 1998).

Classical design is presented below (**Figure 1**). As it can be seen, there is feeder with rather high impedance (~300-600 Ohm), and 1/4-wavelength matching line. From one end, this line is shortened, and here its impedance is just a zero (current is high, but voltage is almost zero). Another end of this line is connected to the long wire, which has length exactly 1/2 wavelength. At this point, the impedance is very high (several kiloohms). That is why, a big voltage exists here during a transmission. This is quite suitable for a wire feeding, because a 1/2-wavelength has high impedance when fed from the end.

Figure 1. Classical Zeppelin-antenna design



The feeder from the transmitter with a specific impedance R_f is connected to the matching line in the point, where impedance of the latter is equal to that of the feeder. Such point is usually located not so far from the shortened end. If everything is done properly, feeder may have any length and SWR is closed to 1:1 in rather narrow band, central frequency of which is determined by the geometrical size of matching line and antenna.

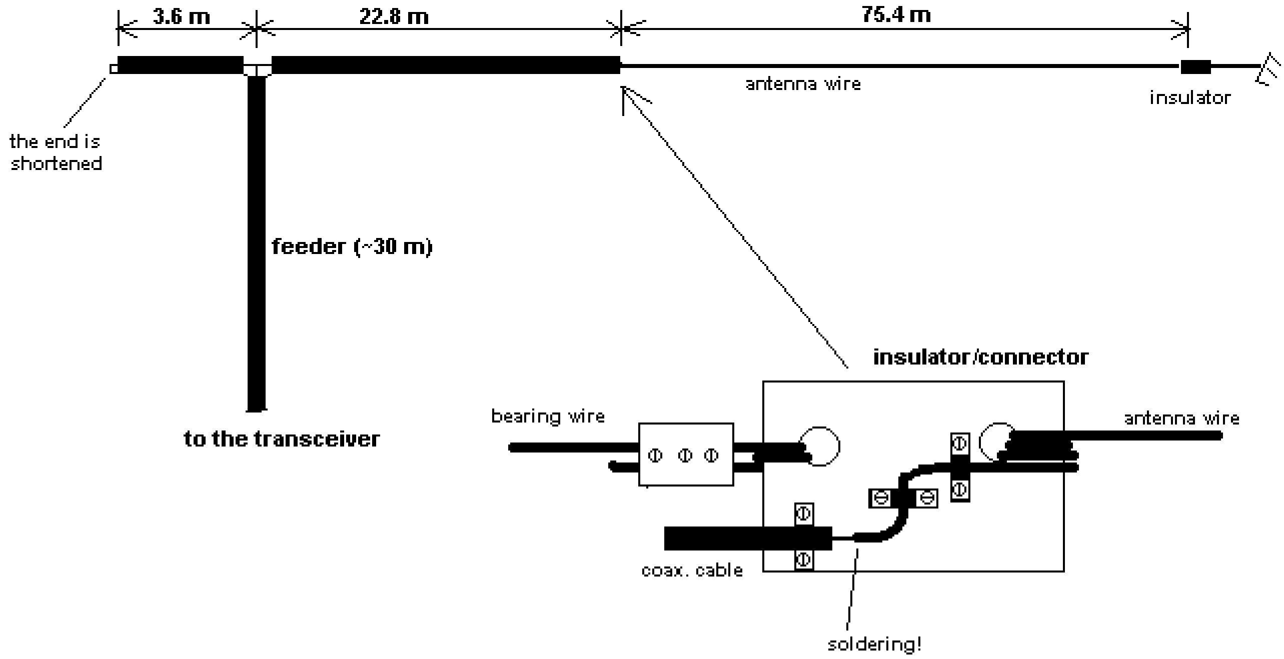
Classical design with a coaxial cable for 160 meters

This design can be used almost without change, but instead of symmetrical feeder a coaxial cable can be used to connect the whole system to the unsymmetrical output of the transmitter (**Figure 2**). Using of a coaxial cable instead of an open line has one big advantage – in contrast with the symmetrical transmission line it is almost insensitive to the environment, weather conditions and can be placed really everywhere.

Such antenna with feeding 'from the end' is much more easy to make, that a simple dipole. Here, antenna wire bears only itself, and this reduces the mechanical strength and thickness of the wire to be used. Also, you may use your window as one the point of antenna fixing. In this case, all the cable will be inside your shack and antenna could be tuned precisely in comfortable conditions. If the beginning of antenna is outside the apartment, most part of matching line can be used as the continuation of the feeding cable.

On **Figure 2** there is a design, that I implemented for using on 160 m amateur band, and which, to my mind, is a perfect solution for the people, who cannot mount a classical dipole.

Figure 2. Long wire antenna for 160 m with a coaxial matching line.



In my case, all coaxial cables have 75 Ohm impedance, the antenna wire, as well as two bearing wires are made from very hard bimetallic insulated cable (outer diameter is about 3 mm). The trickiest part - the connector between cable and antenna - is shown on **Figure 2**.. It should be noted, that voltage on it is quite high, and so everything should be well insulated from each other. It is good idea to place this connector somewhere indoors, otherwise rains and snow may cause decreasing of insulation efficiency and antenna performance. This antenna uses a tuned line made from the coaxial cable, and for proper operation of the whole system the antenna wire should have the length equal to the $\lambda*0.95/2$, and the coaxial line must resonate on the working frequency.

It is a good idea, to connect the shortened end of the matching line to the ground (cold water pipe, heating system, building elements etc.) to provide adequate safety and to reduce possible TV/RF interferences while transmitting.

Tuning and adjusting of the antenna

To achieve what was declared in the previous paragraph, first of all the precise length of the matching line should be determined. Theoretically, it should be closed to $\lambda/(4*\mathrm{sqrt}(d))$ (sqrt - Square Root, d - dielectric constant of the insulator used in the coaxial cable). SQRT(d) value is typically about 1.52 for most cables with polyethylene-based dielectric, that is why, 'shortening coefficient' is about 0.66. But the practical value will be a little different from that.

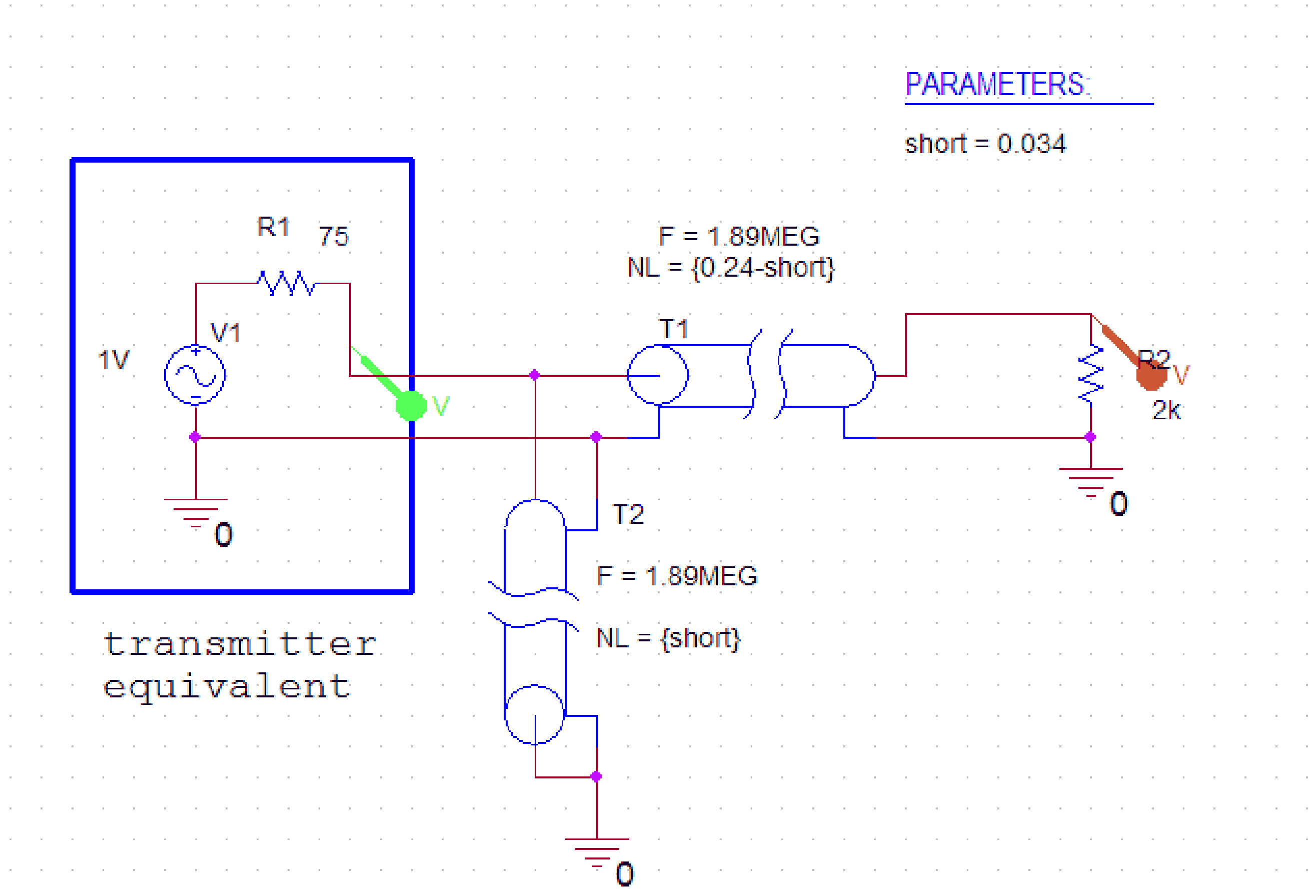
The lengths indicated on **Figure 2** are mine values, and they can be used as the approximate reference. Exact numbers depends on the antenna environment and should be determined experimentally. It should be noted, that in ‘ideal’ case it is not a simple task, because in such system three values have to be varied (one is antenna length, and another two are lengths of the parts of the matching line). But as it appeared from my experience, for practical purposes the most important thing is to choose correct total length of the matching line, which must resonate on the desired frequency.

To do this, I suggest to use the following technique. To make your line resonate on the middle of the band (1890 kHz), you first have to make the line about 1 m longer, that estimated length of the tuned line (for example, 24 m), making shortened segment about 3.6 m. Then, connect the 2-3 kiloohms resistor to the “open’ end of the line, and the transceiver through SWR meter - to the feeder. The resistor here serves as a loading instead of the antenna wire.

After assembling of the system, put RF power (1-2 W or even less is enough) on some frequency inside 160 m band into line and watch the SWR. If the line is completely out of resonance, SWR will be closed to infinity, and no power will be dissipated on the resistor. Then, the frequency should be found, which gives the sharp minimum of the SWR. It has to be around 1800 KHz. Here, the SWR is usually less than 1.5:1, and the full power of the transceiver is dissipated on the resistor, which means, that the matching line works well. When touching the 'hot' end of the loading, it may be seemed, that is really very hot – this is due to the high HF voltage, which causes skin burning (be careful to do it, even by low power of RF source!).

For better understanding of these processes is useful to look to the results of simulation of this system using Pspice simulation software. The equivalent schematics (**Figure 3**) includes voltage source V1 in series with 75 Ohm resistor (which emulates output resistance of the transmitter), two coaxial lines T1 and T2 and loading R2. Since Pspice does not allow to set lengths of the transmission lines directly in length units, they are set in wavelengths (NL) on the specified frequency (in our case, F=1.89 MHz).

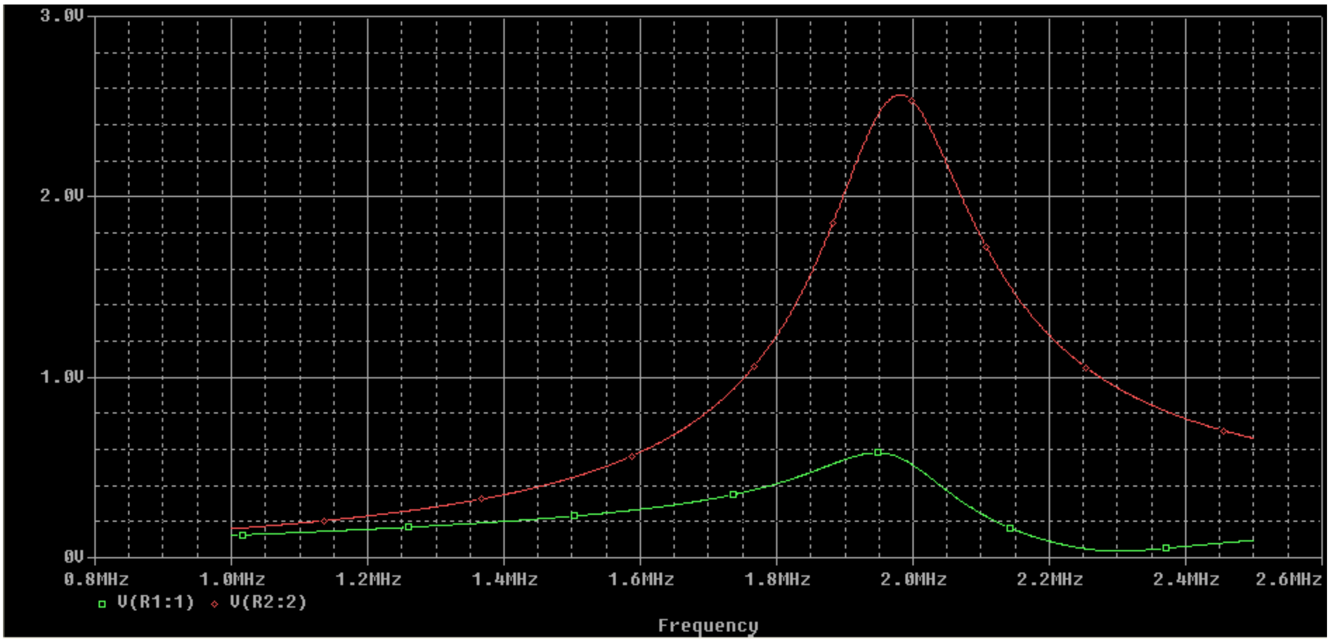
Figure 3. Equivalent schematics for matching line, used for simulation.



Calculated frequency response is presented on the **Figure 4**. Here, the colors of the traces correspond with the colors of the voltage markers on the schematic. As it can be seen, on the resonant frequency about 1.95 MHz there is sharp voltage maximum on R2 (red trace), which reaches 2.6V – it is about 5 times more, than the voltage on the transmitter's output (green trace). Also it should be noted, that on the resonant frequency voltage on R1 (green trace) is closed to one half of source voltage (in our case, 1V). Practically, it means, that there is good matching between transmitter and the "antenna" and most of generated power is dissipated on the loading.

After the resonance has been found, it should be shifted up to the desired frequency. To do this, the end of the cable should be cut carefully in several steps, watching the resonance frequency each time, which must increase with each cut. After you achieve the desired frequency, the matching line is almost ready, and you can mount the whole antenna system in the chosen place. It should be noted, that the minimum of the SWR in mounted antenna is usually 20-30 kHz down, compared to the value achieved by the tuning on the resistor.

Figure 4. Frequency response of the matching line in range 1 – 2.5 MHz



In my case, the antenna for 160 m band had a minimum of SWR at 1875 kHz (about 1.3:1), on the edges of the band SWR increased to 2.0…2.5:1, since the design is a narrow-band one. Compared to my previous dipole, which hanged on the low height (about 5 meters over the ground) along the building, this antenna exhibited much better transmission efficiency and higher signal to noise ratio while receiving.

The same design for 10 meters - cheap and simple.

About 2 years after getting my first amateur license I upgraded it to the higher license class, which allowed me to operate on 10 meters SSB. In that year, there was a perfect propagation on 10 meters band during the daylight time, and I needed an efficient antenna to work on it. Probably, in some time I will have something like rotable multielement Yagi on my roof, but now it seems to me inaccessible as the Moon due to many factors. After some time I decided to repeat what I built for 160 meters for 10 meters, proportionally reducing all geometrical sizes of the antenna wire and matching line.

Since the wavelength on 28500 KHz is just 10.52 m, a half-wavelength dipole should be about 5 meters, and the total length of the coaxial matching line will be 10.52/(4*1.52) = 1.73 m. The feeder is connected to the line 23 cm away from the shortened end. These sizes are relative small and the whole antenna system may be placed without being mounted on the roof, for example just from your window to the neighboring tree.

I made the antenna from a 2 mm copper wire with a plastic insulators at the ends, using 75 Ohm coaxial cable for feeder and matching line. There was nothing difficult to tune the system - I hanged the antenna across my apartment and adjusted the length of the matching line as described above for 160m design using 1.80 m as the starting value. The only thing that should be noted is that the actual resonance of the line is very sensitive to the length variations, so on the final steps the cable should be cut in 1 cm (!) portions or even less to not miss the desired resonance position. After I hanged the antenna on the designated position, SWR was less then 1.5 on all frequencies ranging from 28200 to 29000 KHz.

This antenna is really very simple and cheap, but nevertheless, I allowed me to establish many connections with Europe and even Far East using just about 10 Watts of power. I really enjoyed working on 10 meters ether in local communications and transnational QSOs, and this was made possible just by several hours of time, dedicated to the antenna building and tuning.

About working on other bands – some facts and theory.

Though LW antennas with a feeding through coaxial transformer, which were described above, seem to be monoband, this appeared not completely true. As I found out, the whole system has many resonant frequencies, and some of them, are inside or near amateur bands and can be used for working on these bands.

As it could be expected, operation on the frequencies, which are twice more that ‘native’ ones, is impossible. When using an antenna for 160 m, on 80 m band observed SWR is closed to infinity and the transmission efficiency is not more that by using a random wire with length of several meters... Simply it can be understood, that on doubling the working frequency the matching line is completely out of resonance, and works as a "short" for the transmitter. But everything has advantages, and this fact means not only impossibility to work on 80 m, which is definitely bad, but also deep suppression of 2- nd harmonic by working on 160 m, which is really well.

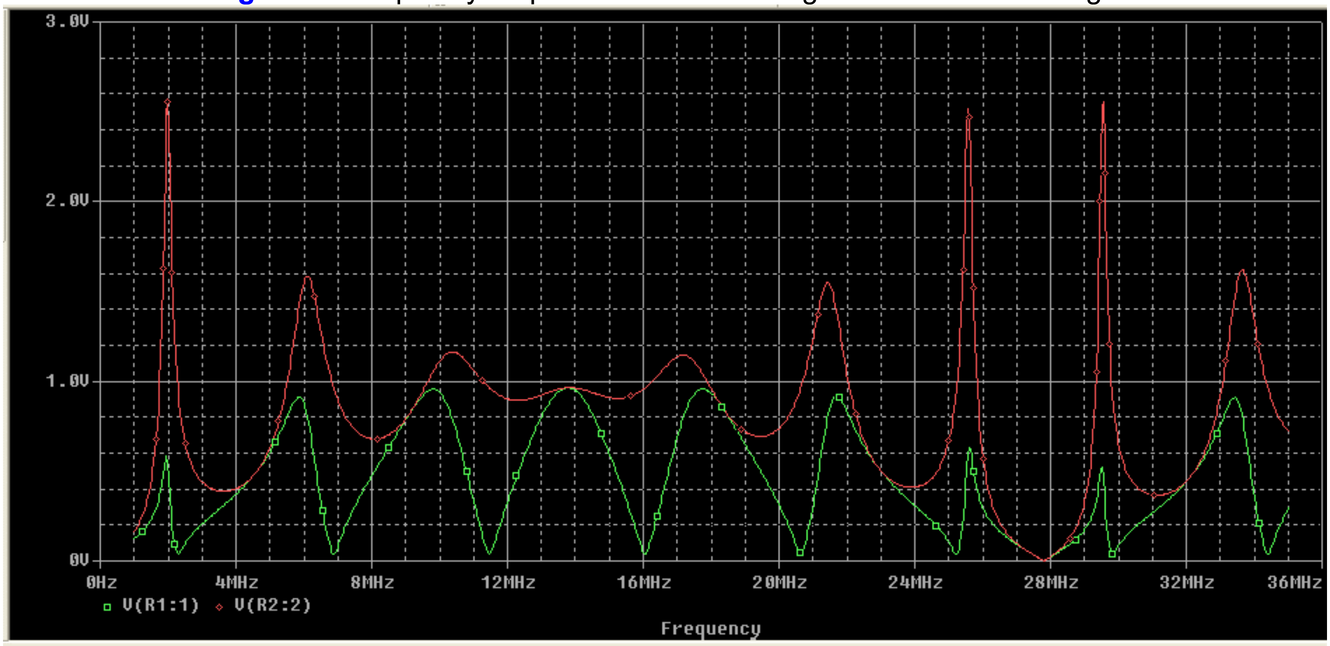
Almost the same situation is on 40 m band. Here the active component of input impedance of the antenna (measured by noise bridge) is also quite low (several Ohms), and no resonance exists inside or near amateur frequencies.

But if you try to work on this antenna on 15 and 10 meters bands, the situation is more optimistic. In my case, on 21430 KHz the SWR was about 1.3:1 and increases to 2.5:1 when moving down to 21000 KHz. Measured impedance was about 55 Ohm with a low capacitive reactance. From first sight, it is quite strange, but nevertheless, antenna behaved well on this band, and using just 10 W of power, I was able to make long-distance QSO's even with North America. The most interesting fact was, that this was "true" resonance of the antenna, without any participation of the feeder (SWR did not change significally when the feeder length was alternated).

In contrast to this, on 10 meters band the antenna behaves very poor – the air seems to be "empty", and even common industrial noise is received with a level comparable to internal noise of the receiver. Compared to the special 10 meters antenna (see above), the signal of distant correspondents were weaker by 10-20 dB (!), and on transmission even my neighbors gave me reports like 53-54. However, when frequency was moved up to 29 MHz and higher, the efficiency improved dramatically.

To understand this phenomenon, some calculations were performed. First of all, it was found, that frequency response of the matching line with a resistive loading (see **Figure 3**) in range 1.5 – 32 MHz has many maxima, and one of them is inside 15-m amateur band (**Figure 5**, red trace). Another maxima is near 29.5 MHz – in the upper part of 10-m band.

Figure 5. Frequency response of the matching line in whole HF range



I guess, that these results may be assumed at least as a qualitative explanation of the antenna behavior. I say "qualitative" because the whole system can not be adequately represented by a matching line with a resistor at the end – impedance of the antenna wire also should be taken into account. However it is clear, why besides 'native' band, antenna works well on 21 MHz, and why on frequencies about 28500 there is a minimum of performance, which rapidly increases when moving up to 29 MHz.

Conclusion

As a conclusion is can be said, that LW antenna with a coaxial matching line (J-antenna), which is designed for 160 m band, can do perfect job on 15 meters and on a part of 10 meters band also without any switching and tuning devices. Of course, the efficiency on 'upper' bands is be substantially lower, that on 'native' one due to RF losses in the matching line (which actually works with a very high SWR). But to my mind it is still acceptable, especially in the case, when there are no conditions to mount huge and efficient antennas.

MULTIRANGE TRAP ANTENNAS

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Multirange trap antenna: history and fundamentals

Recently multirange trap antennas are widespread among radioamateurs. As matter of fact, the type of antennas was invented in the USA by H. K. Morgan, US patent # 2229856, 1938 (by reference **[1]**). Probably the first article about a trap antenna was published in reference **[2]** at 1940. So, what is the antenna and how is it work? Let's see it on the example of a ham vertical trap antenna in order to simplify a problem. **Figure 1** shows us a schematic of such antenna.

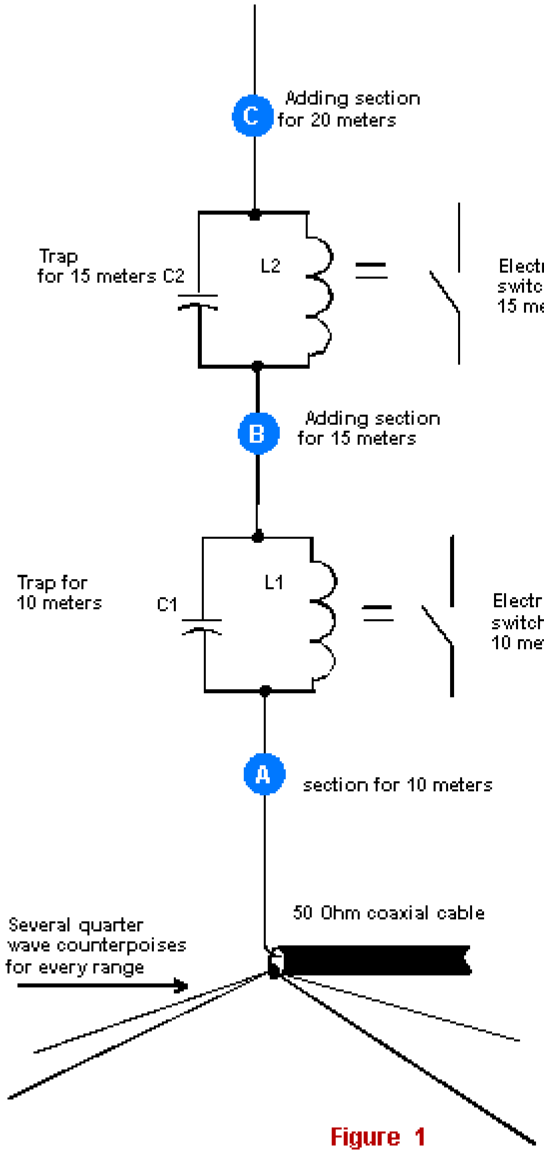


Figure 1 A ham vertical trap antenna

10 meters: Section A is tuned for operation on 10-meters by its length. Trap L1C1 turn off upper antenna parts behind the trap from operation of the antenna when 10 meters range is used.

15 meters: By length of the Section B we tune the antenna parts "Section 1 plus L1C1 plus Section B" to resonance to 15-meters. Trap L2C2 turn off upper antenna parts behind the trap from operation of the antenna when 15 meters range is used.

20 meters: By length of the Section C we tune the antenna parts "Section 1 plus L1C1 plus Section B plus Section C" to resonance to 20-meters.

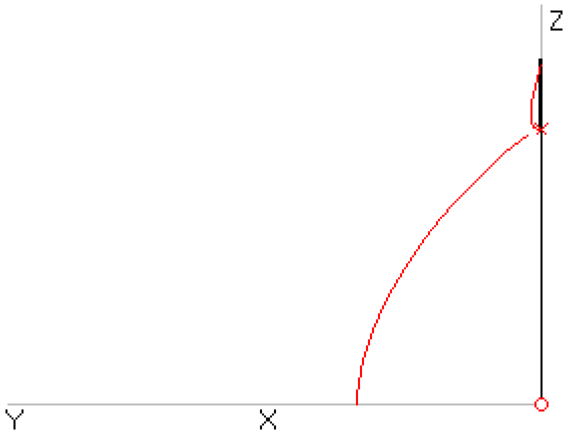
And so on for other ranges: In the similar way the antenna would be tuned for others ham HF- ranges. You see, it is possible to do an antenna for any number of HF- ranges! But there are several lacks. Upper parts of the antenna behind a proper trap do not use (or, practically do not use) for radiation. Another lack is that the antenna wire is broken at several places by trap circuits. Every trap circuits should be tune in to own resonance frequency. Trap circuits must have high temperature stability, because the antenna is used at the open air. Traps work at a resonance mode so a high level of RF voltage is across trap capacitors at transmission mode. Thereof it needs to use a high quality capacitor for every of the traps.

Vertical trap antenna WA1LNQ: One of the most popular sample vertical trap antenna is the antenna WA1LNQ **[2]**. The antenna is used on 10 and 15 meters. **Figure 2** shows the scheme for the antenna.

The antenna made from two insulated from each other metal tubes by length of 240,7 (section A) and 62,9 (section B) centimeters and in OD 18 to 25 millimeters. The length of an insulating insertion is 5,8 centimeters. Over the insulating part is spooled the trap spool. A copper tube in diameter of 3 to 5 mm is used for the spool, and the spool contains 2 turns with step 1 turn on 25-mm of winding. Average diameter of the trap spool is 55-mm. As a trap capacitor is used a length of a 50-Ohm coaxial cable with an initial length equal to 80 centimeters.

Tuning of the Antenna WA1LNQ: At first, tune the antenna in 10-m range. At the tuning the length of the coaxial cable, that makes the trap capacitor, is gradually shortened to minimum SWR in 10 meters. After this, tune the antenna to minimum SWR at 15 meters. It is possible to do by a small changing of the length of the upper section B.

Below you can see input impedance, SWR and DD of the antenna W1LNQ. The figures are obtained with the help of Free Antenna Simulation Program



Current Distribution at 10 meters

Current Distribution at 15 meters

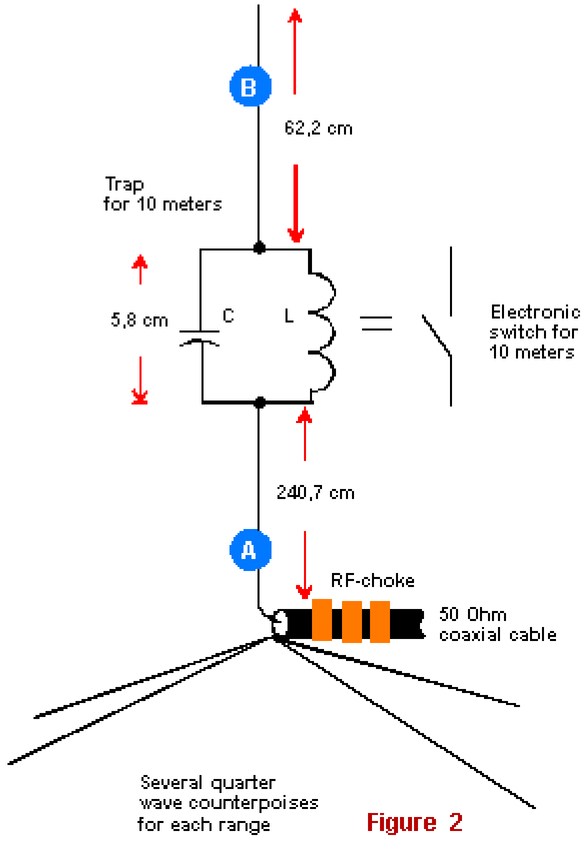
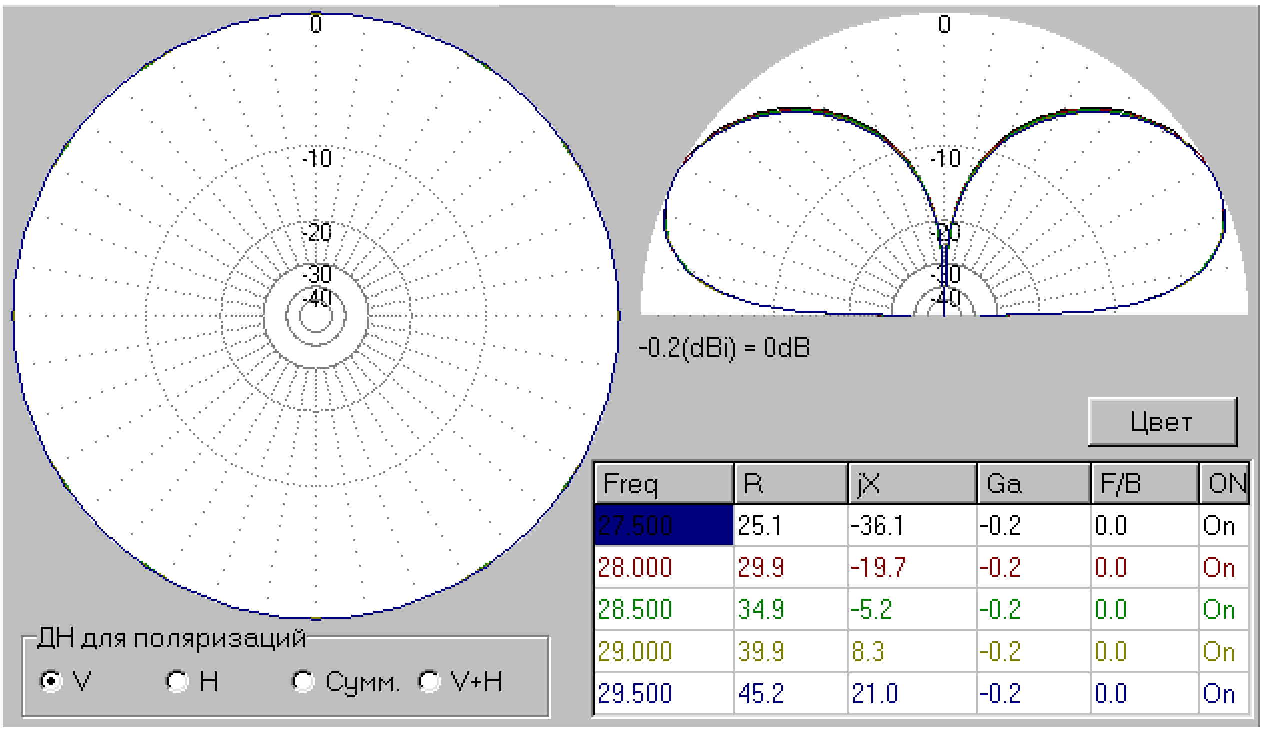


Figure 2 Antenna WA1LNQ

Diagram Directivity and Input Impedance at 10 meters W1LNQ Antenna



Freq	R	jX	Ga	F/B	ON
27.500	25.1	-36.1	-0.2	0.0	On
28.000	29.9	-19.7	-0.2	0.0	On
28.500	34.9	-5.2	-0.2	0.0	On
29.000	39.9	8.3	-0.2	0.0	On
29.500	45.2	21.0	-0.2	0.0	On

MMANA (MININEC based). Section A has diameter of 24 millimeters, section B has diameter of 18 millimeters.

Antenna input impedance. Vertical Trap antenna: You can see that only first antenna part, it is section A at **Figure 1**, has length in λ/4. So, the input

SWR at 10 meters W1LNQ Antenna

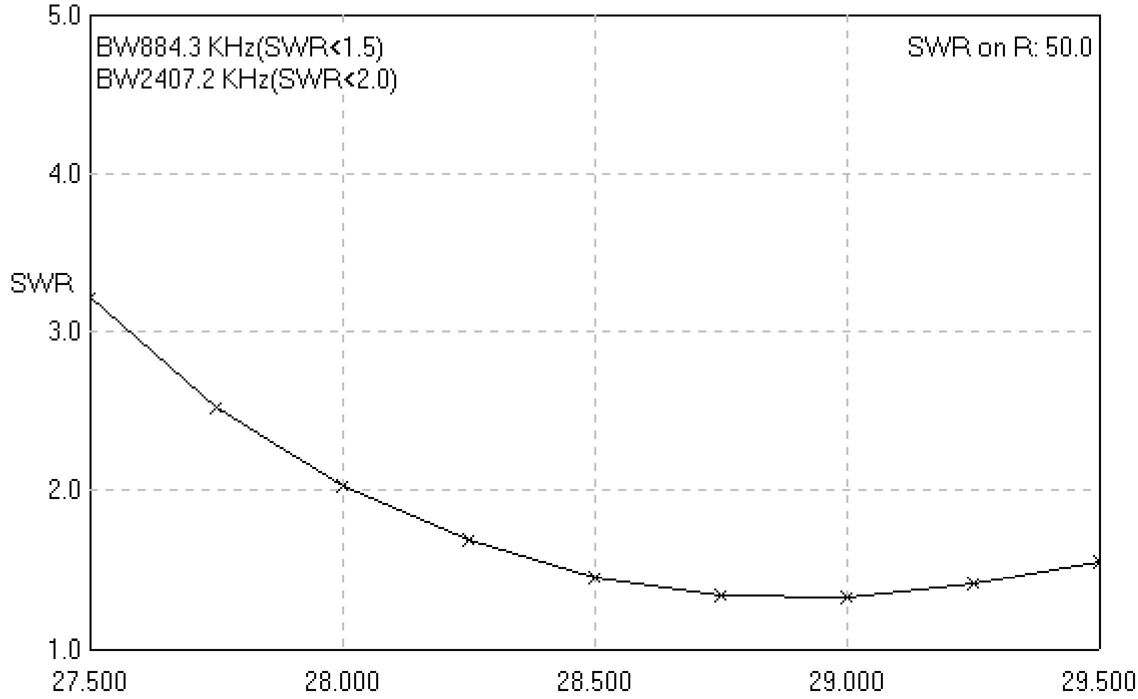
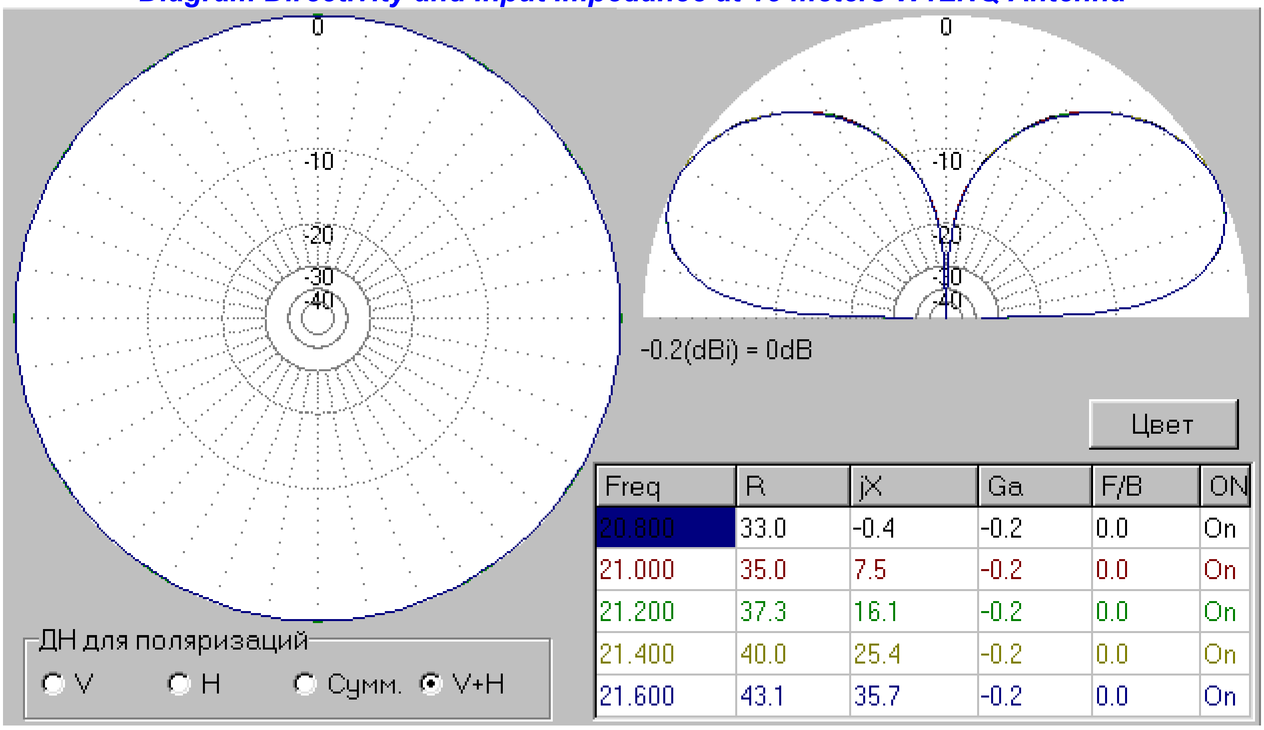
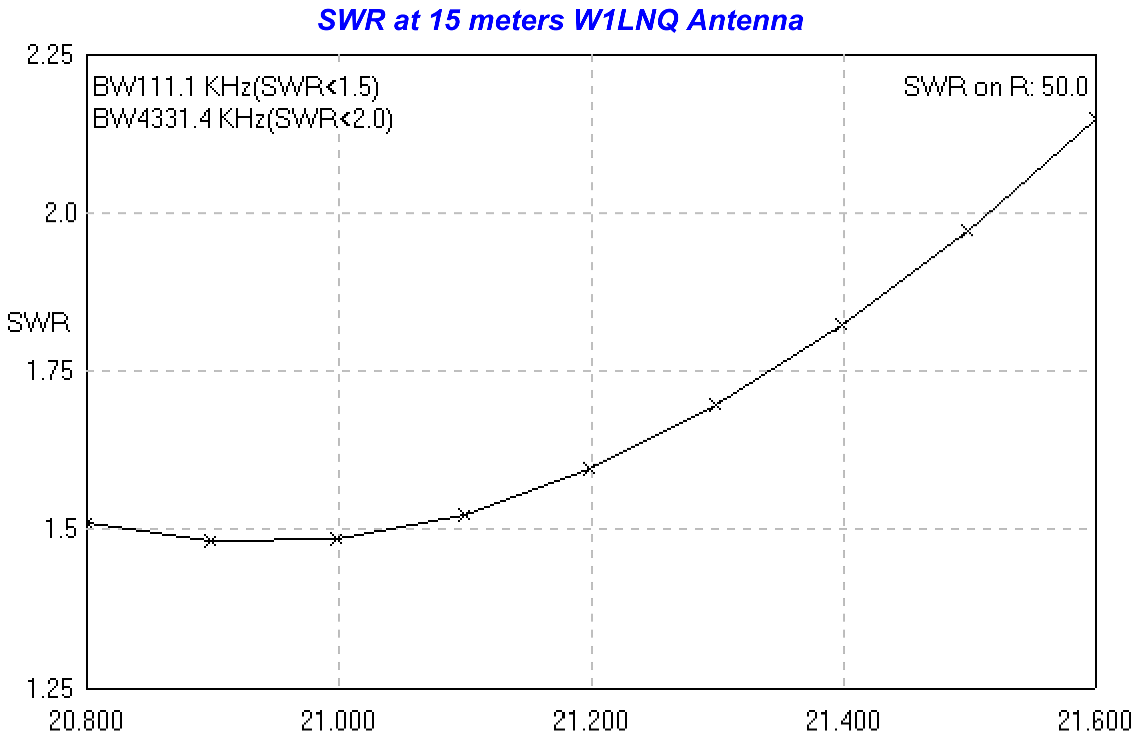


Diagram Directivity and Input Impedance at 15 meters W1LNQ Antenna



impedance of the antenna at 10 meters is close to 40-Ohms, and50-Ohms coaxial cable can be used for feeding of the antenna at the range. However, physical length of antenna consisting of another following section plus the previously section (or sections) is less then λ/4. Inductors of the traps work as a lengthening spools for the proper section. Input impedance of the antenna working at lower then 10 meters range is less then 30 Ohms in the theory, but in practice, the input impedance for 15 and 20 meters range is close to 40 Ohms because losses in antenna parts and antenna ground. So, a 50-Ohms coaxial cable can be used for feeding of the antenna at all of the ranges. For a proper work a vertical trap antenna must have several counterpoises for every of operation ranges, especially for low amateur HF ranges 40-, 80- and 160-m.

Antenna input impedance. Dipole Trap antenna: Morgan trap antenna **[1]** was done as a dipole. It is known, that a λ/2 (physical length) dipole antenna has input impedance close to 75 Ohms, see **Figure 3A**. A shortened by a lengthening spool dipole



antenna with electrical length in λ/2 (having physical length bit less then λ/2) has input impedance less them 75 Ohms and maybe, close to 60- 50-Ohms, see **Figure 3B**. So, for feeding a dipole trap antenna a 50-Ohms coaxial cable can be used with a high efficiency.

A dipole trap antenna is very easy for tuning and has high efficiency, however, radio amateurs very seldom make as a vertical as dipole trap antenna having a number of traps more than one. The reason is that the antenna sections should be electrically insulated from each other. It is hard enough to do a mechanical strength design of such antenna in radio amateur conditions. Radio amateurs usually prefer a W3DZZ antenna. The antenna has only one trap, and, as it seems by many hams, works at several amateur ranges. What is a W3DZZ?

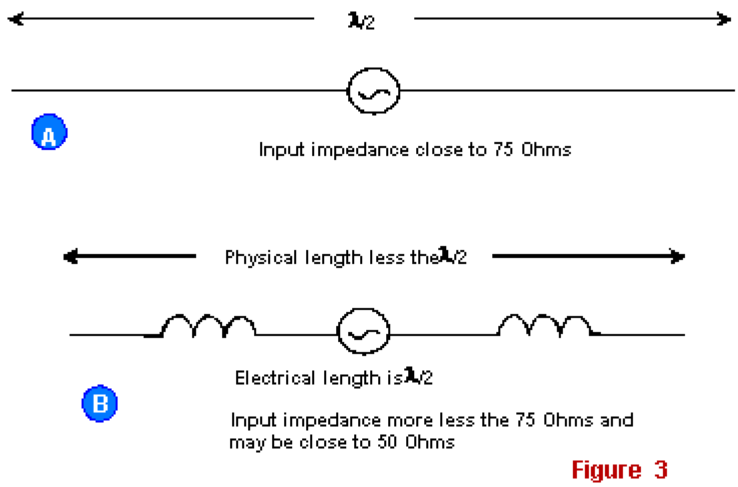


Figure 3 *A shortening and full size dipole antenna*

Antenna W3DZZ: In1955 C. L. Buchanan. W3DZZ, developed a multirange dipole antenna with only one trap, see reference **[4]**. Recently the antenna is known as "antenna W3DZZ." **Figure 4** shows schematic of the antenna W3DZZ.

Antenna W3DZZ works in several amateurs range with low SWR in its feeder. Proper choosing data of the trap turns the trap or to lengthening inductor at low range (ranges) or to shortening capacitor at high range (ranges), or to only a trap at a proper range. For the antenna shown at **Figure 4**, trap LC is the trap for 40

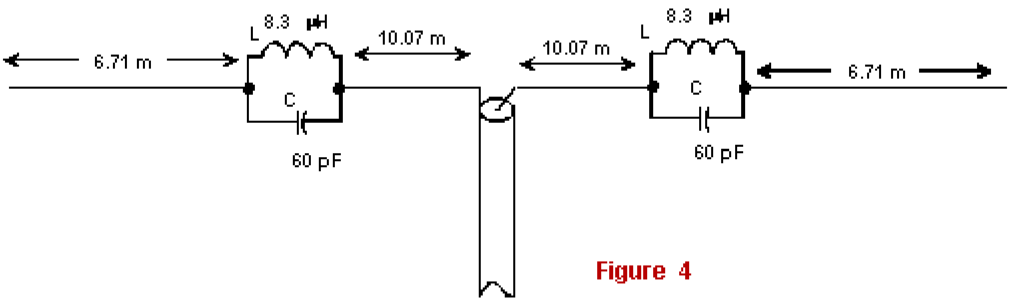
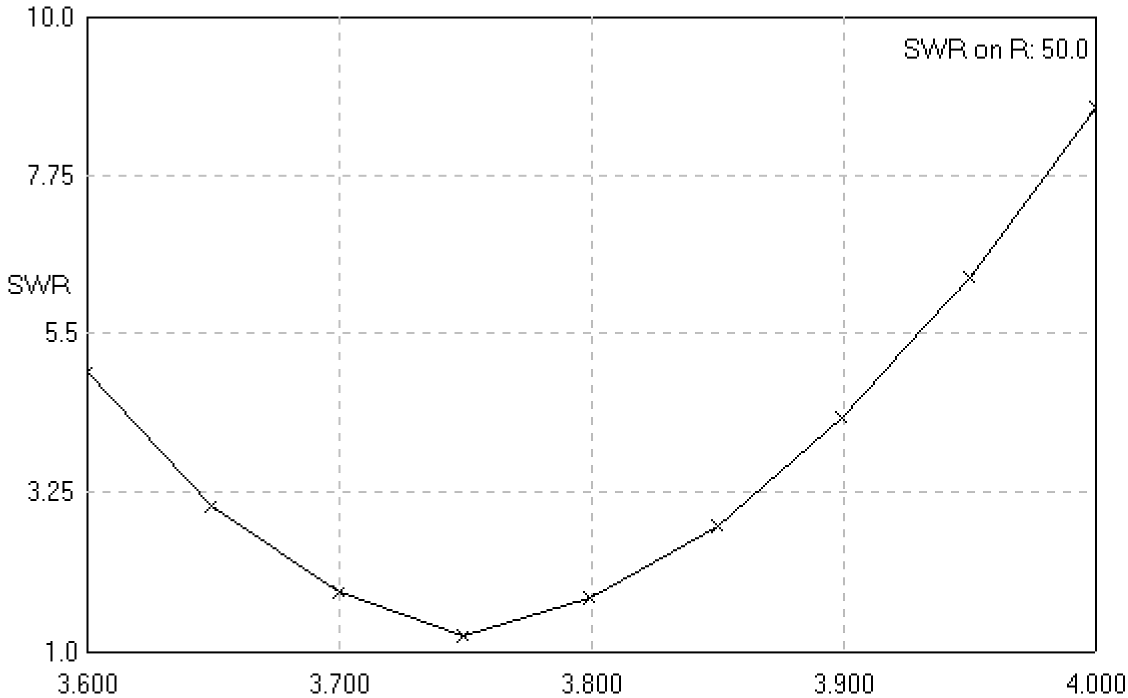
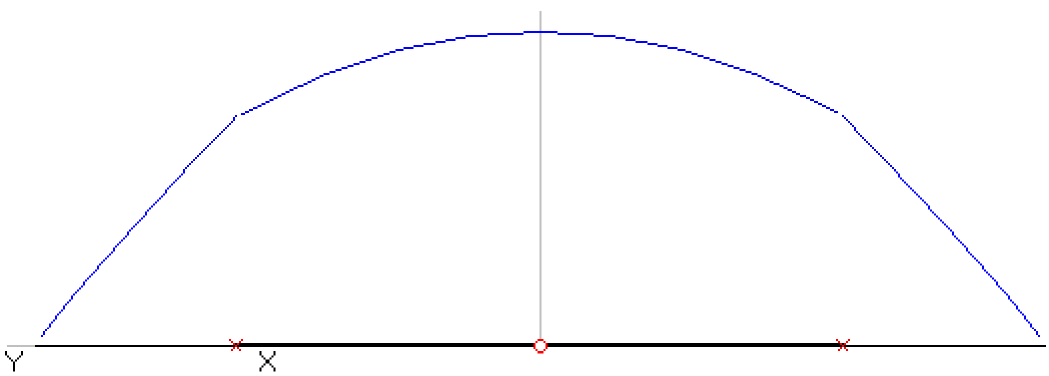


Figure 4 *Antenna W3DZZ*

meters, lengthening inductor for 80 meters, and shortening capacitor for 20, 15 and 10 meters. The antenna (**Figure 4)** does not work at WARC bands. However, the antenna does not work properly at 20, 15 and 10 meters. You can see data obtained with ***Free Antenna Simulation Program MMANA*** ***(MININEC based)*** for the W3DZZ (see **Figure 4**). Antenna wire has diameter of 2 millimeters. You can see, that a SWR at 20, 15 and 10 meters is too high. It is impossible to find such length of the antenna and data for trap that the antenna works at all of the ranges! So, an ATU and a good coax is need for the antenna if you work at 20, 15 and 10 meters.

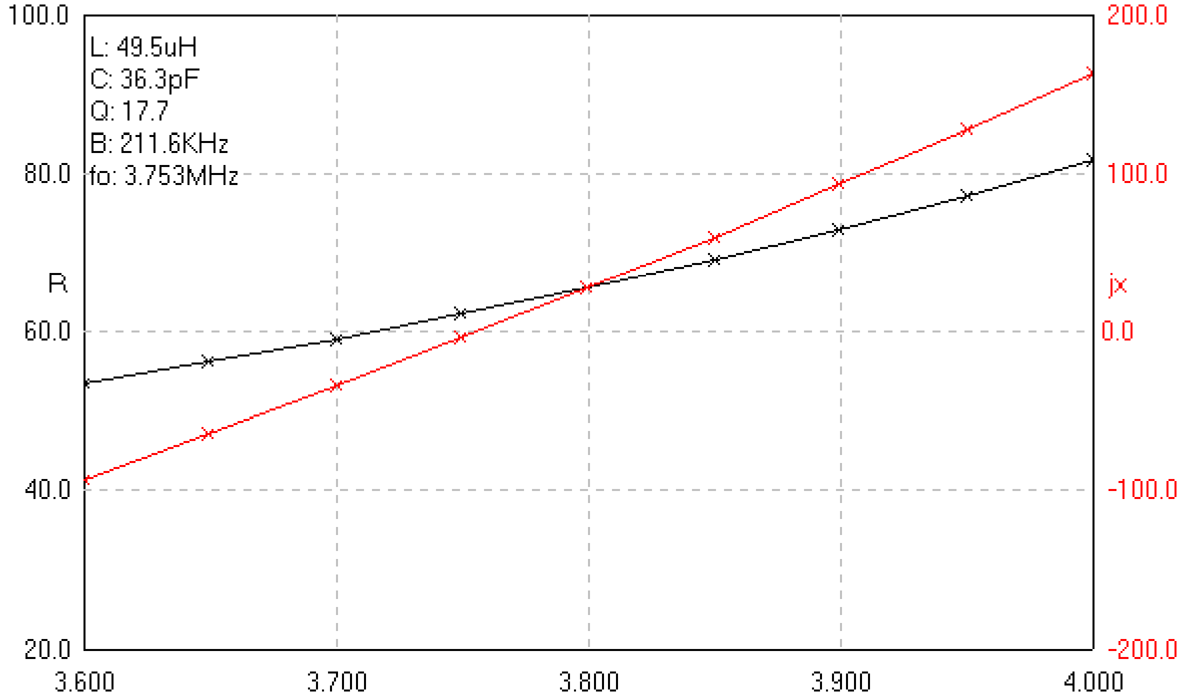
SWR at 80 meters W3DZZ Antenna



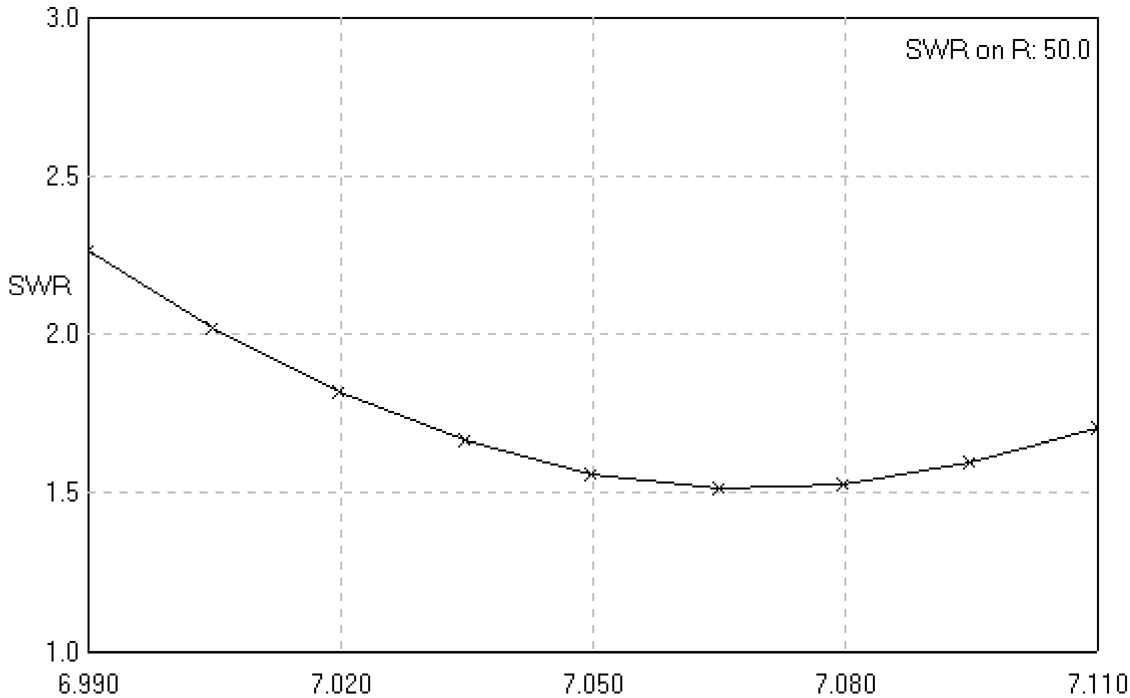


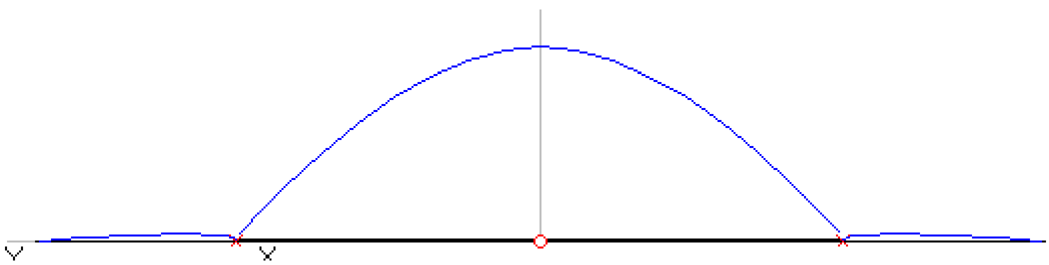
Current Distribution at 80 meters W3DZZ Antenna

Input Impedance at 80 meters W3DZZ Antenna



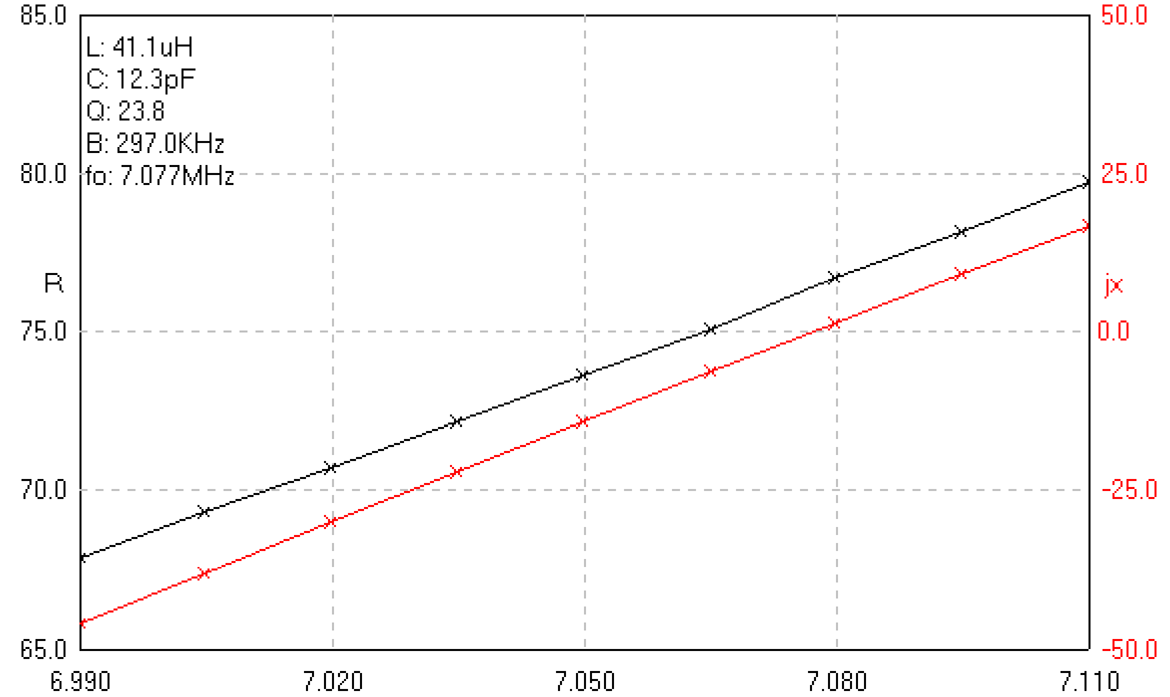
SWR at 40 meters W3DZZ Antenna



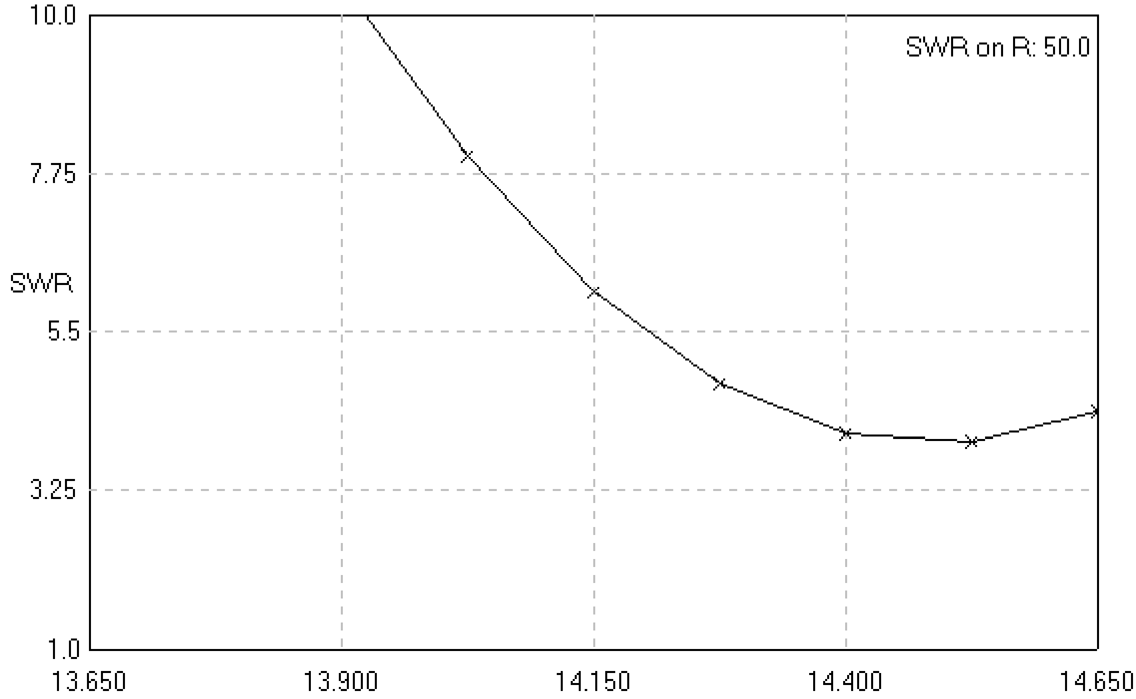


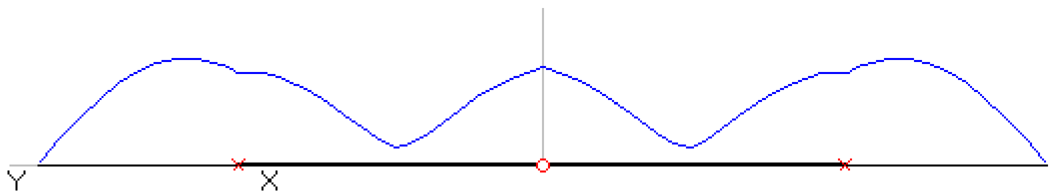
Current Distribution at 40 meters W3DZZ Antenna

Input Impedance at 40 meters W3DZZ Antenna



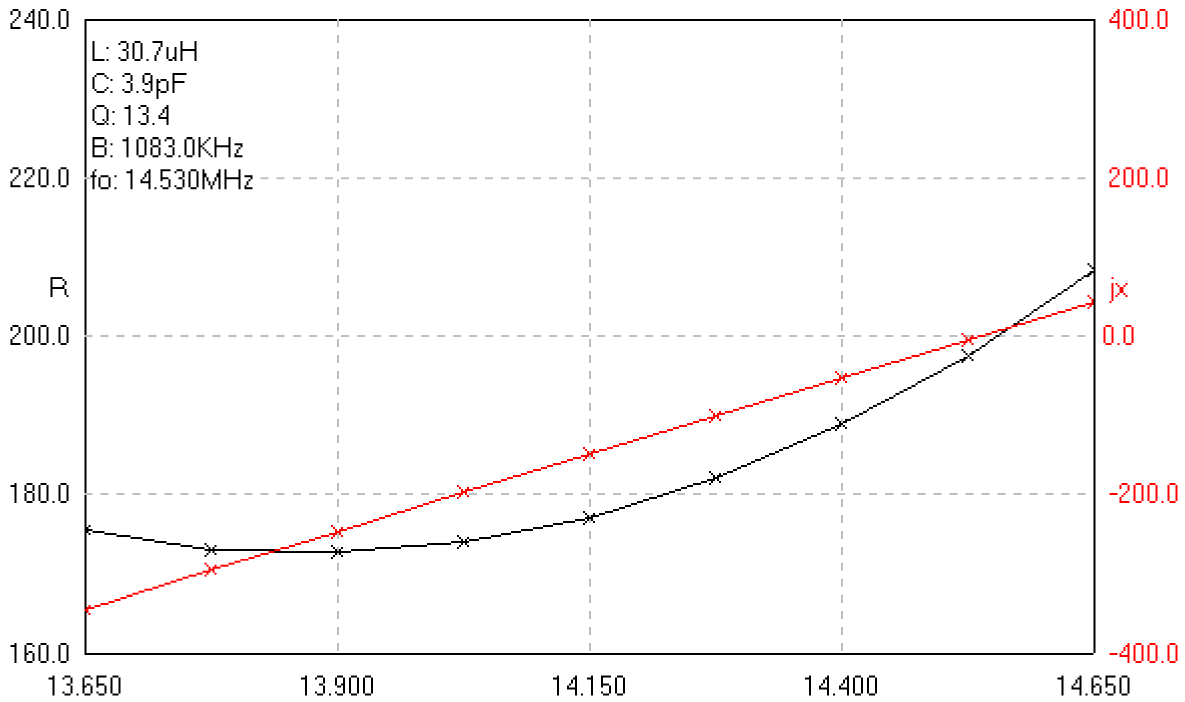
SWR at 20 meters W3DZZ Antenna



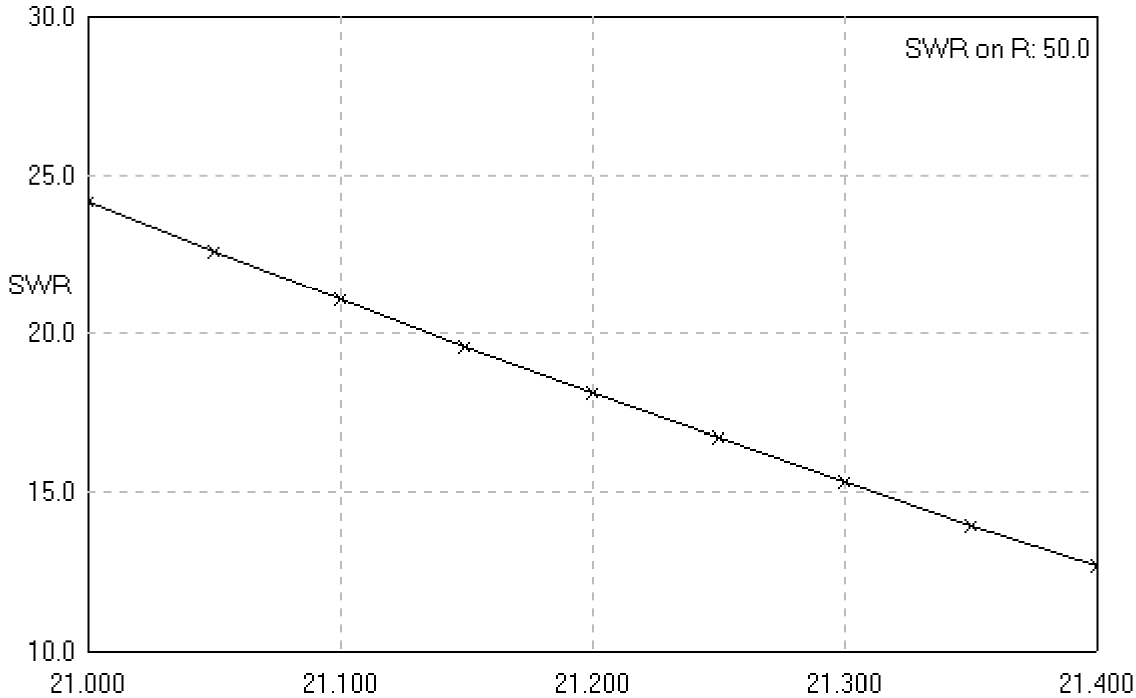


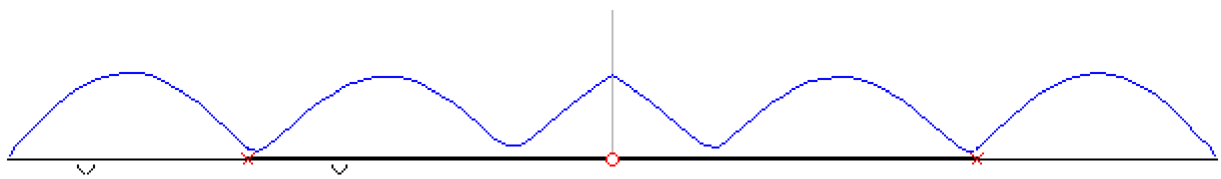
Current Distribution at 20 meters W3DZZ Antenna

Input Impedance at 20 meters W3DZZ Antenna



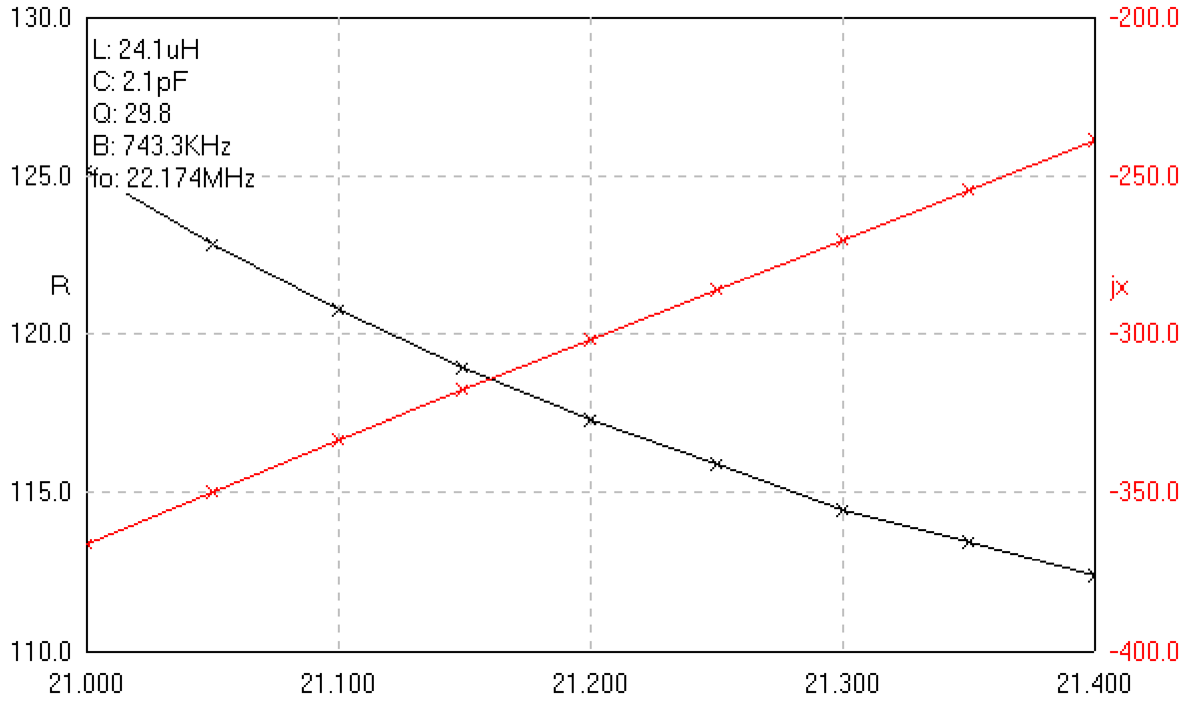
SWR at 15 meters W3DZZ Antenna



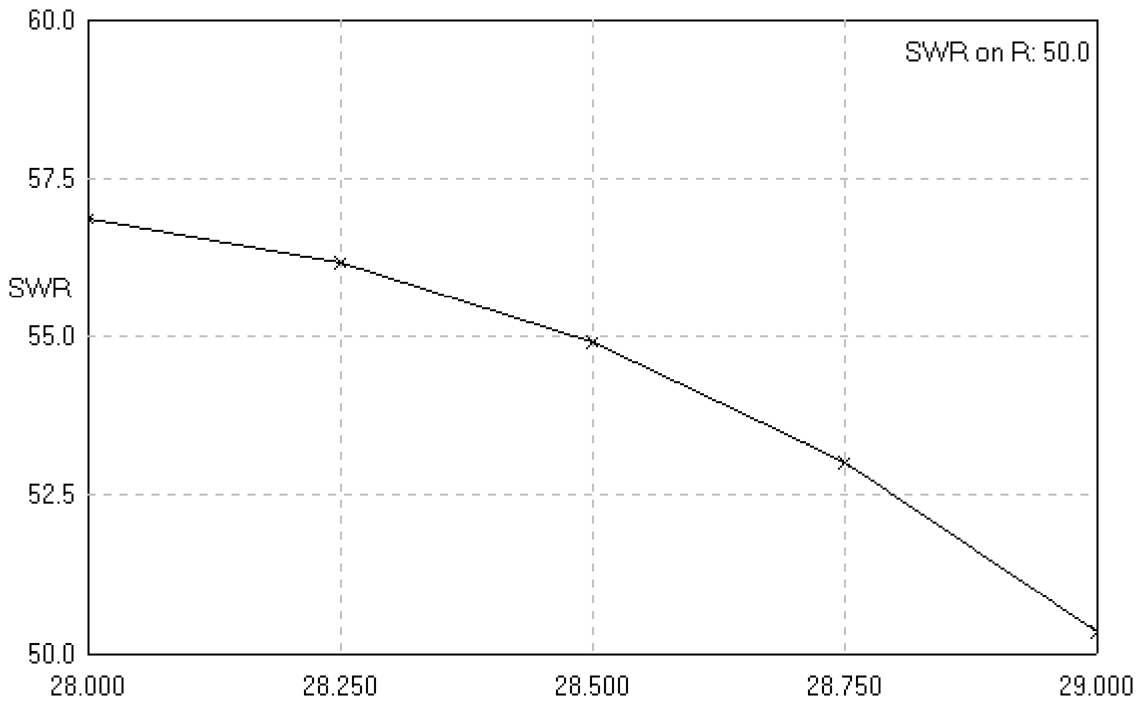


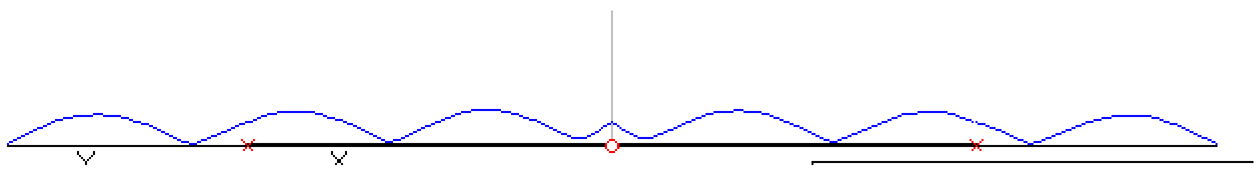
Current Distribution at 15 meters W3DZZ Antenna

Input Impedance at 15 meters W3DZZ Antenna



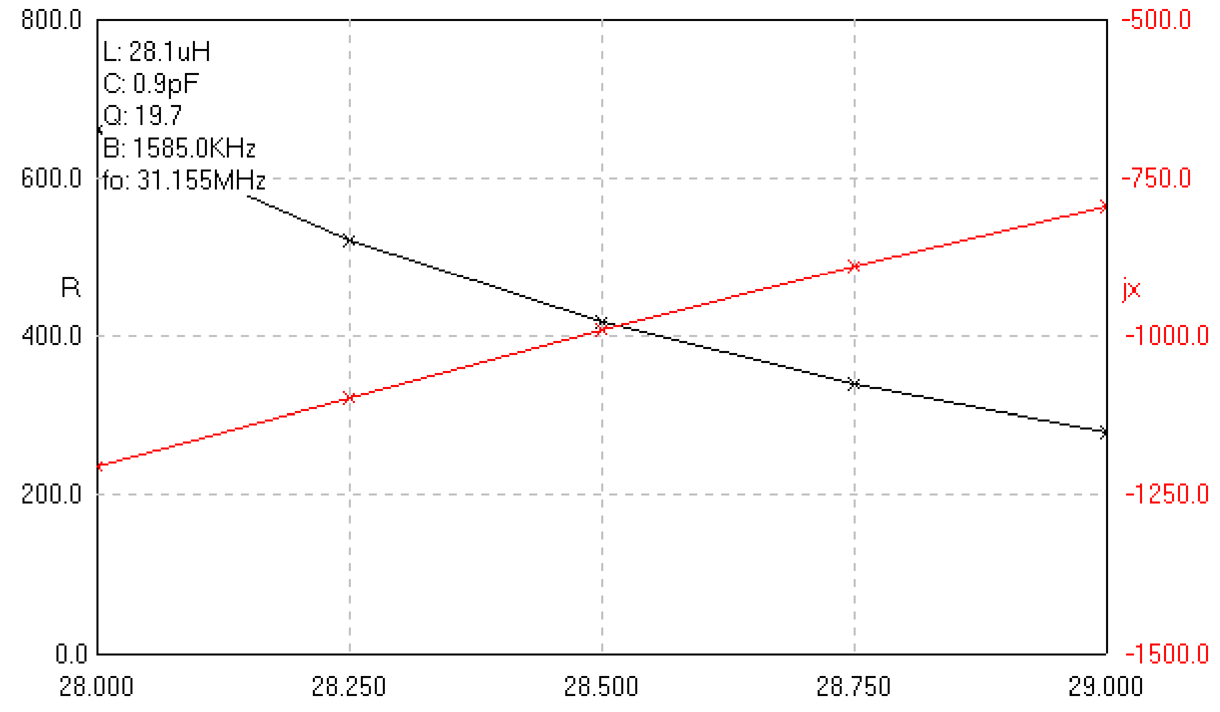
SWR at 15 meters W3DZZ Antenna





Current Distribution at 10 meters W3DZZ Antenna

Input Impedance at 10 meters W3DZZ Antenna



Antenna W3DZZ has input impedance close to 60 Ohms at 80 and 75 at 40, , so, a 75-Ohms coaxial cable can be used for feeding of the antenna.

Hams make antenna W3DZZ also in a vertical installation, where the antenna has input impedance close to 30- 40 Ohms (in twice less the dipole design), so a 50-Ohms coaxial cable can be used for feeding of the antenna at all of the ranges. For a proper work a vertical trap antenna must have several counterpoises for every of operation ranges, especially for low amateur HF ranges 40-, 80- and 160-m.

LC trap design: Trap spool has 8.3-μH and contains 19 turns of silvered copper wire of diameter in 3-mm. Diameter of winding is 50-mm. Length of winding is 80-mm. The trap should be tuned to resonance to the frequency 7,05 (7.2 for USA) MHz. It is possible use a GDO for the tuning. A capacitor at 3-pF is bridged to trap capacitor when the trap is tuning to the resonance. The capacitor is simulated a stray capacitance of the antenna sections.

Antenna tuning: At first, with the help of a GDO tune trap to 7,05 (7.2 for USA) MHz. Trap is tuned separately from antenna. At second, get a minimum SWR on 40 meters by length A. At third, get a minimum

SWR on 80 meters by length B. At thus, you can get SWR (well, see in the above figures, the SWR is not so at 20, 15 and 10 meters.

Four band vertical one-trap antenna:

Hams often use a shortened sample of the W3DZZ antenna intended for 40, 20, 15, and 10 meters. At radio amateurs literature there are several description of the antenna, as at dipole as at vertical installation. However, the first description, which I found off for a vertical four band trap antenna, was made by K2GU in reference **[5]**. **Figure 5** shows the schematic of the antenna.

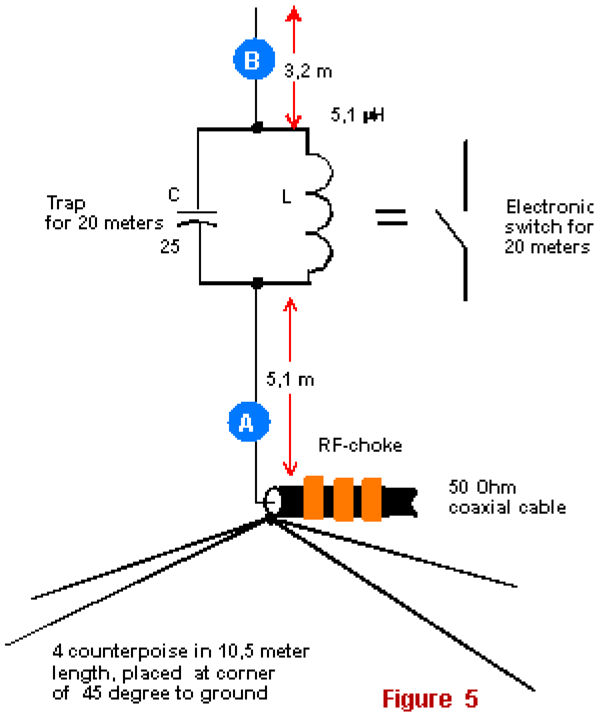


Figure 5 *A four-band trap vertical antenna*

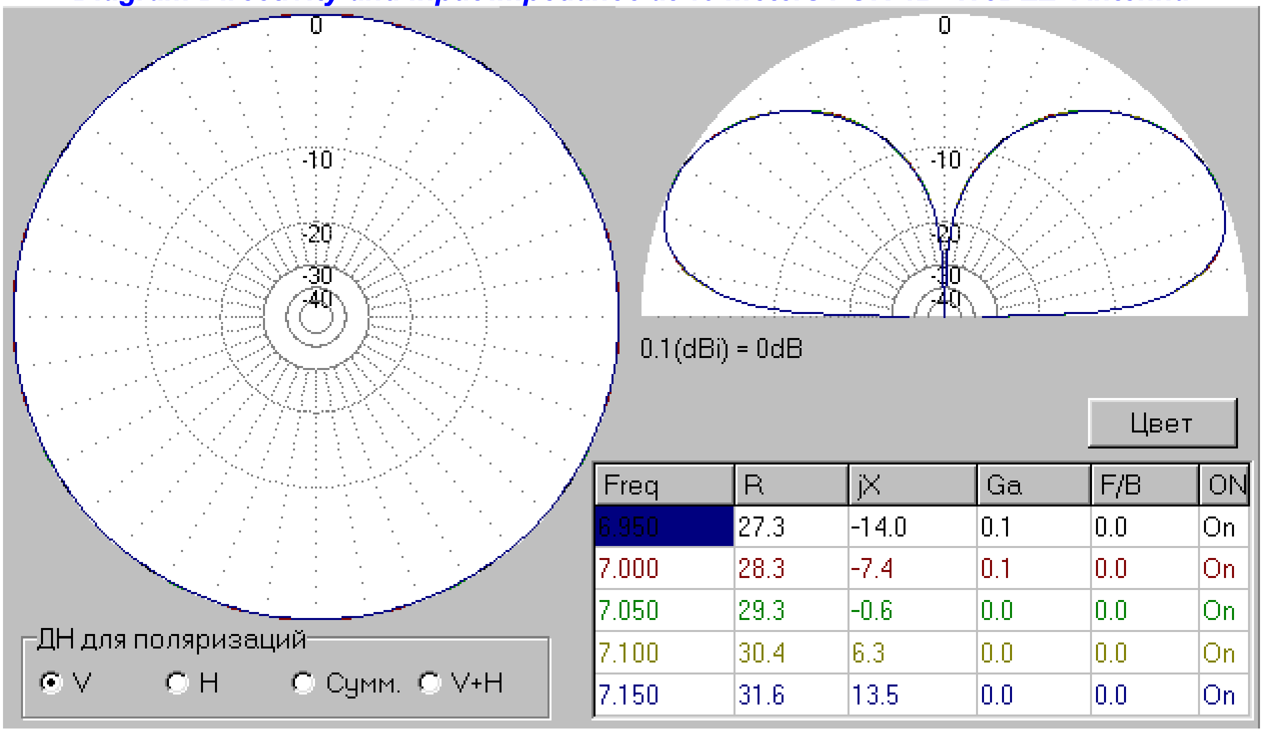
20 meters: Section A is tuned for operation on 20-meters by its length. Trap LC turn off upper antenna parts behind the trap from operation of the antenna when 10 meters range is used.

40 meters: By length of the Section B we tune the antenna parts “Section 1 plus LC plus Section B” to resonance to 40-meters.

15 and 10 meters: The trap serves as a shortening capacitor at that ranges.

Below you can see input impedance, SWR and DD of the antenna W1LNQ. The figures are obtained with the help of Free Antenna Simulation Program MMANA (MININEC based). Section A has diameter of 20 millimeters, section B has diameter of 10 millimeters. You can see, that a SWR at 15 meters is too high. It is impossible to find such length of the antenna and data for trap that the antenna works at all of the ranges. So, an ATU and a good coax is need for the antenna if you work at 15 meters. A 50-Ohm coaxial cable can be used for feeding of the antenna at all of the ranges.

Diagram Directivity and Input Impedance at 40 meters FOR 4B- W3DZZ Antenna



SWR at 40 meters FOR 4B- W3DZZ Antenna

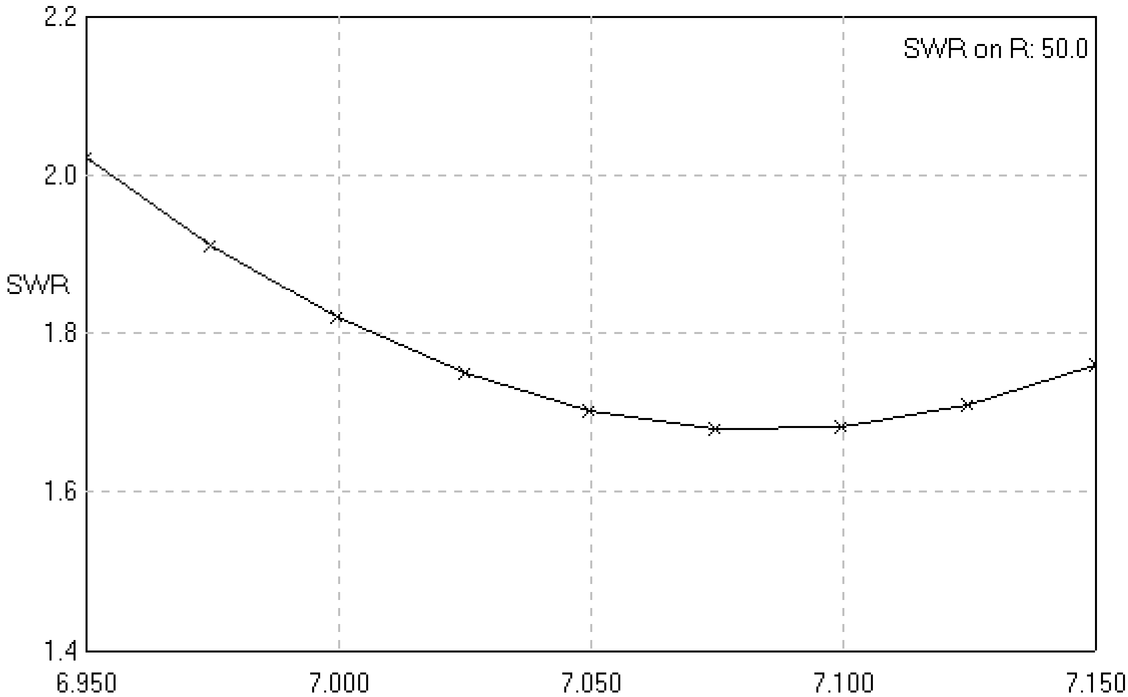
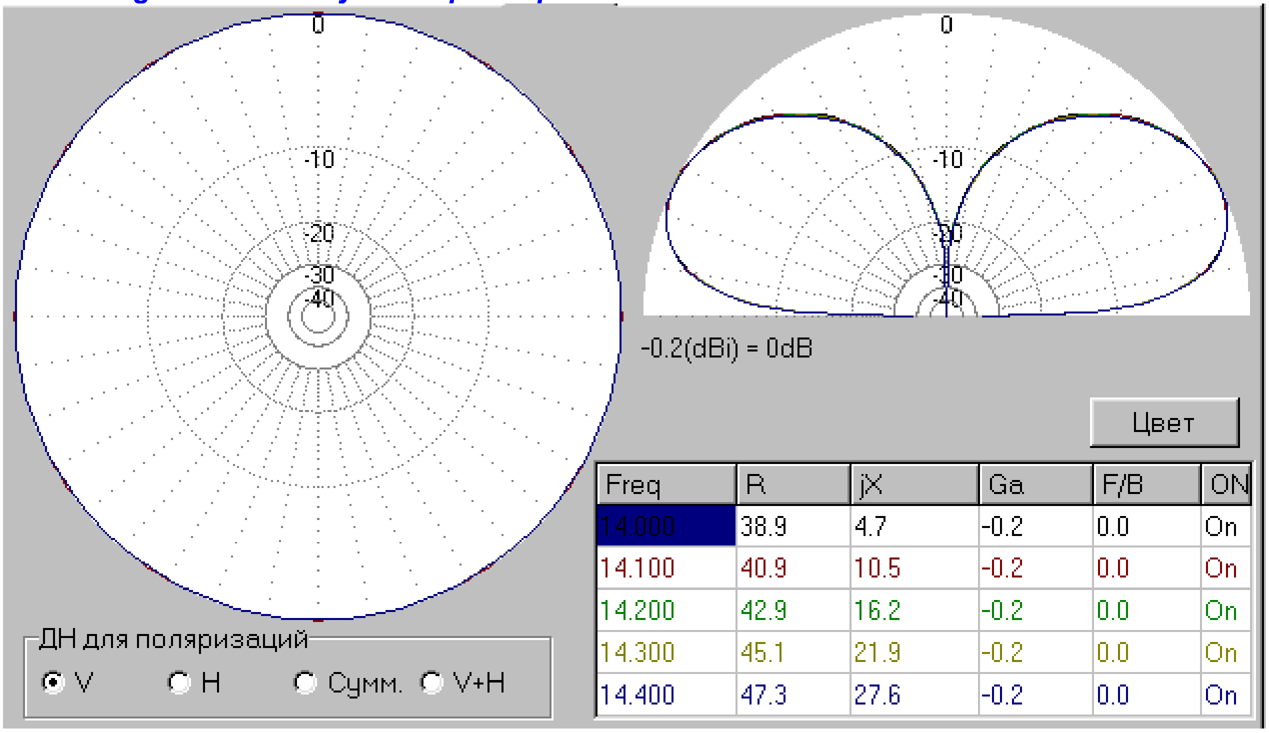
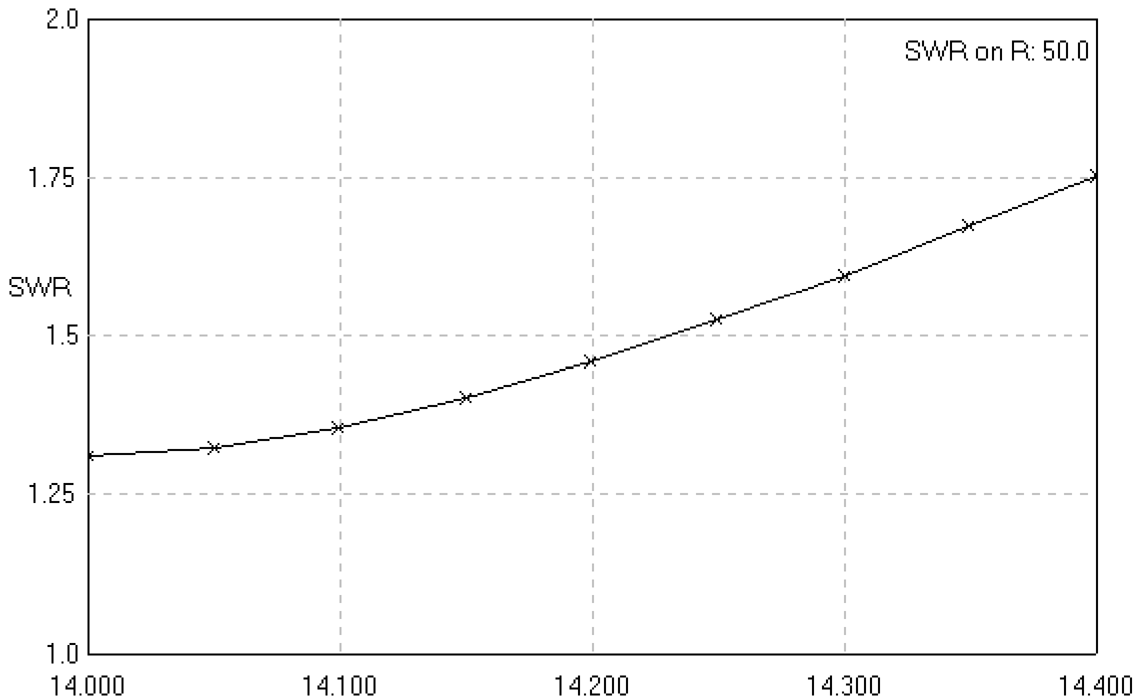


Diagram Directivity and Input Impedance at 20 meters for 4B- W3DZZ Antenna

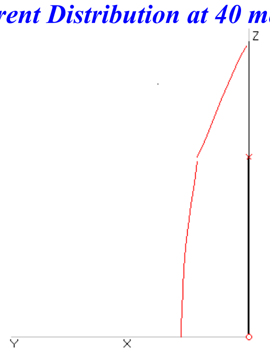


Freq	R	jX	Ga	F/B	ON
14.000	38.9	4.7	-0.2	0.0	On
14.100	40.9	10.5	-0.2	0.0	On
14.200	42.9	16.2	-0.2	0.0	On
14.300	45.1	21.9	-0.2	0.0	On
14.400	47.3	27.6	-0.2	0.0	On

SWR at 20 meters FOR 4B- W3DZZ Antenna



Current Distribution at 40 meters



Current Distribution at 20 meters

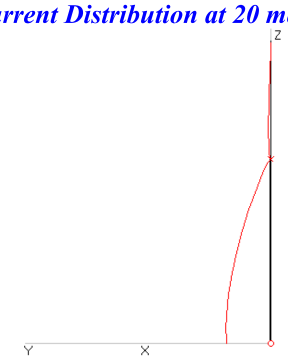
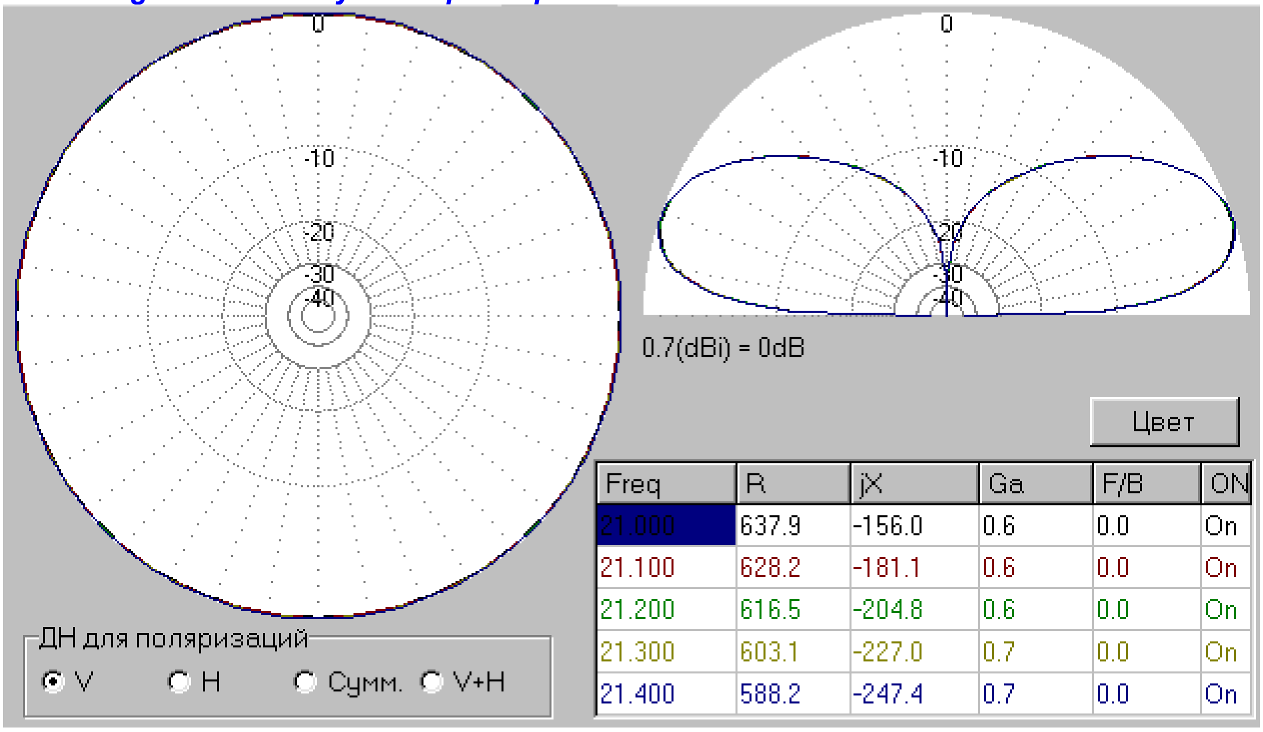
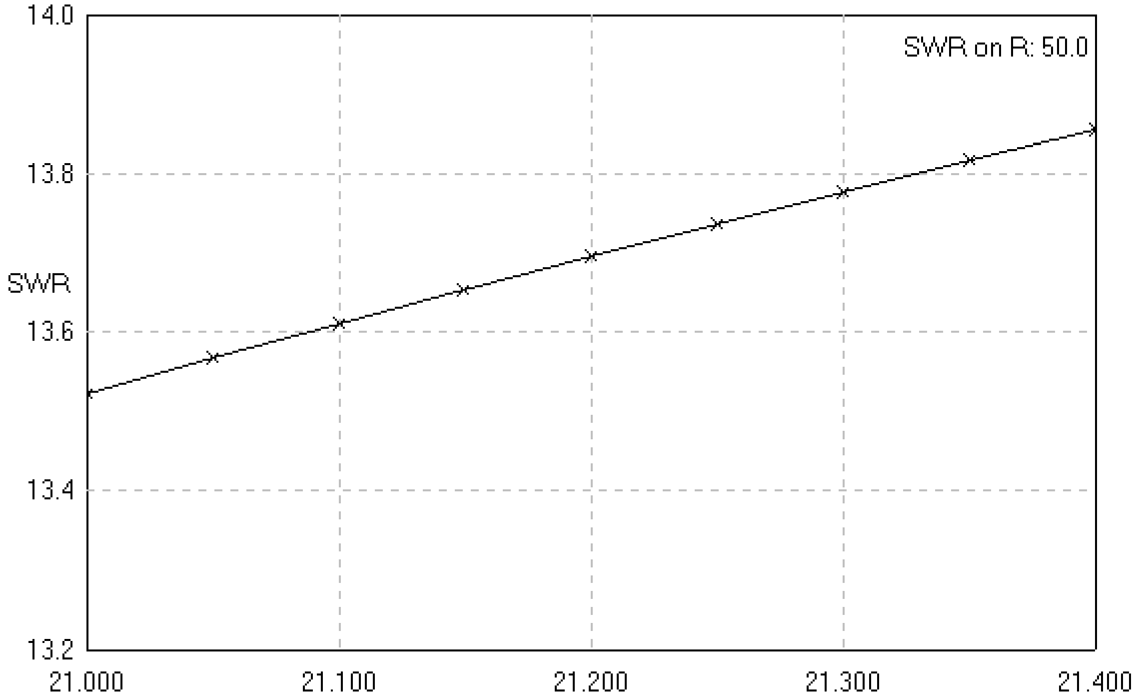


Diagram Directivity and Input Impedance at 15 meters for 4B- W3DZZ Antenna

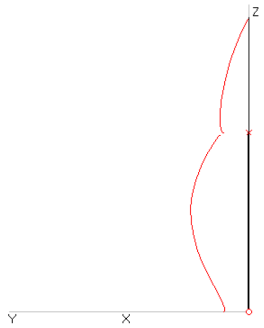


Freq	R	jX	Ga	F/B	ON
21.000	637.9	-156.0	0.6	0.0	On
21.100	628.2	-181.1	0.6	0.0	On
21.200	616.5	-204.8	0.6	0.0	On
21.300	603.1	-227.0	0.7	0.0	On
21.400	588.2	-247.4	0.7	0.0	On

SWR at 15 meters FOR 4B- W3DZZ Antenna



Current Distribution at 15 meters



Current Distribution at 10 meters

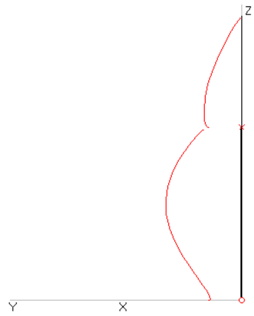
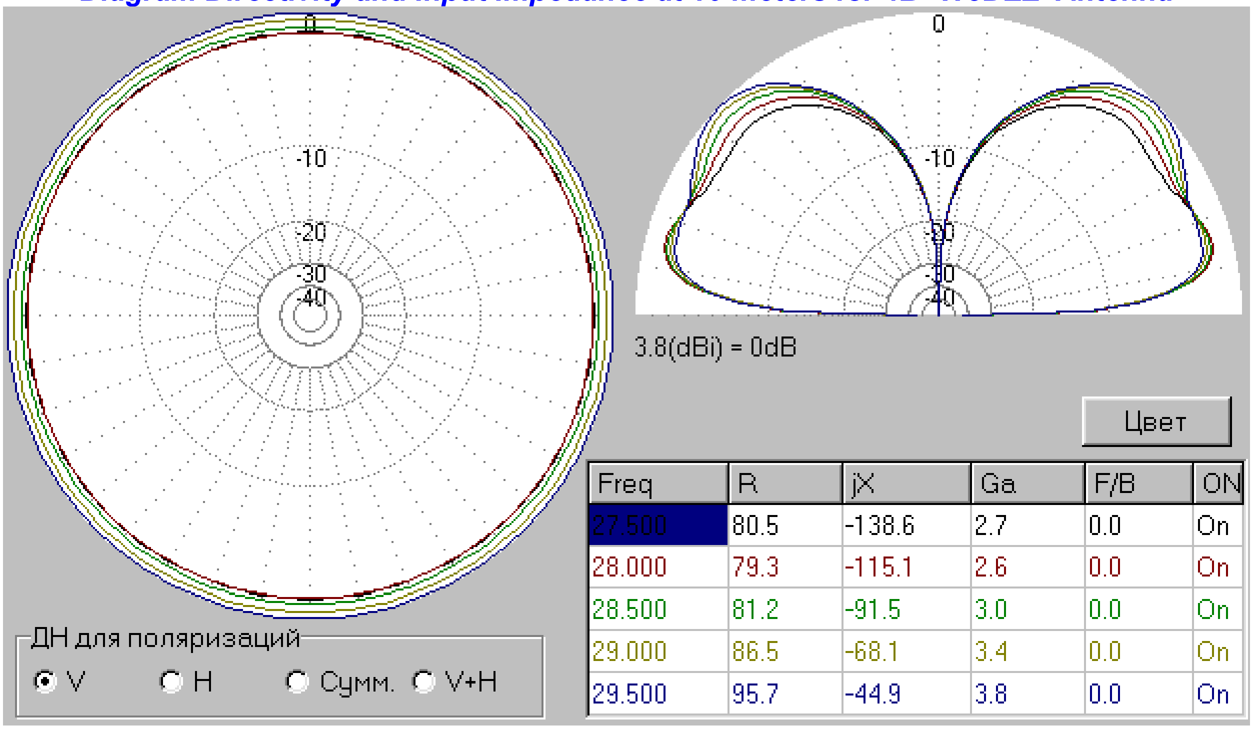
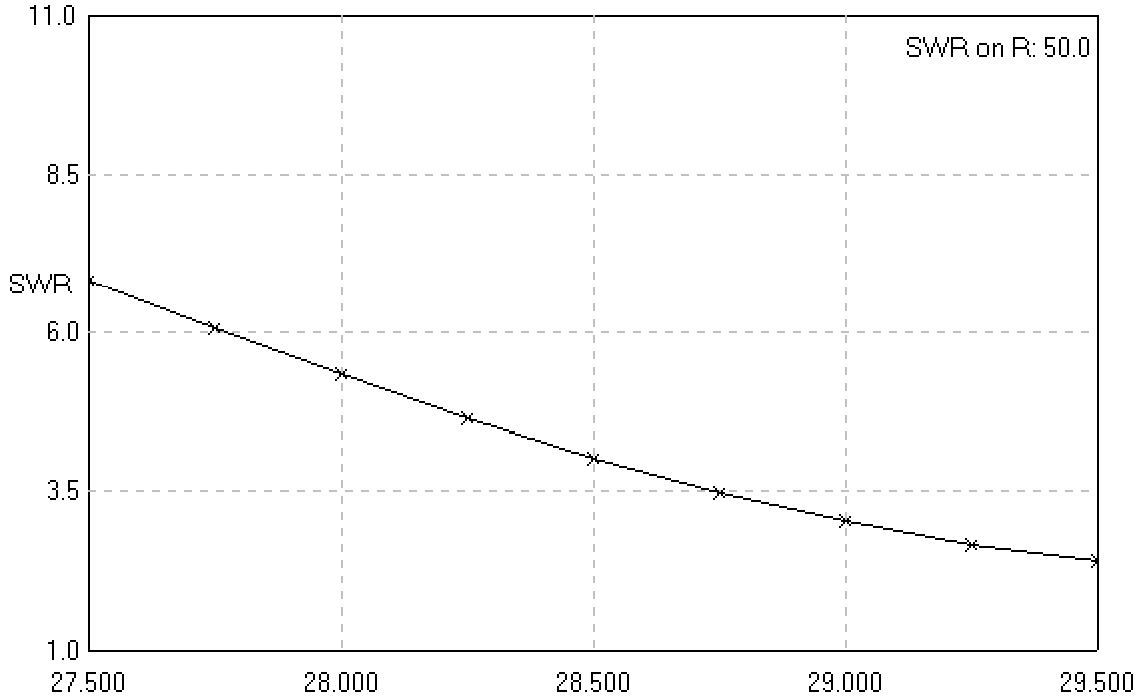


Diagram Directivity and Input Impedance at 10 meters for 4B- W3DZZ Antenna



Freq	R	jX	Ga	F/B	ON
27.500	80.5	-138.6	2.7	0.0	On
28.000	79.3	-115.1	2.6	0.0	On
28.500	81.2	-91.5	3.0	0.0	On
29.000	86.5	-68.1	3.4	0.0	On
29.500	95.7	-44.9	3.8	0.0	On

SWR at 10 meters FOR 4B- W3DZZ Antenna



Trap design: Trap spool contains 10 turns of copper wire diameter in diameter of 2-mm, form of the spool has diameter of 60-mm, distance between turn is 4 mm. The LC circuit should be tuned to frequency of 14.2-MHz. It is possible use a GDO for the tuning. A capacitor at 3-pF is bridged to trap capacitor when the trap is tuning to the resonance. The capacitor is simulated a stray capacitance of the antenna sections. It is necessary to safe trap capacitor from the atmospheric effect.

Antenna tuning: At first, with the help of a GDO tune trap to 14.2-MHz. The circuit tune separately from antenna. At second, tune length A to a minimum SWR in 20 meters. At third tune length of the Section B to minimum SWR at 40 meters.

Common notice for vertical multi range trap antennas

Counterpoises: For a proper work a vertical trap

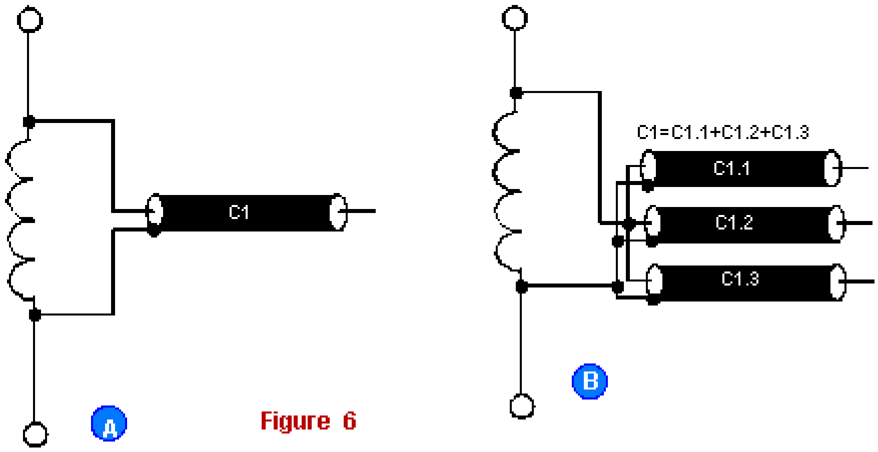


Figure 6 A coaxial cable capacitor

antenna need resonance (a quarter wave) counterpoises for each operation range. Use not less than two counterpoises. If the antenna is placed at a small altitude above a metal roof and braiding of feeding coaxial cable have good electrical contact with the metal roof, the antenna can be used without any counterpoises.

Antenna feeding: Quite possible to use a 50- Ohm coaxial cable for vertical trap antenna feeding. Also it is possible to use a two wire line for dipole and vertical trap antenna feeding. In this case it need ATU between the line and the transceiver.

A trap capacitor: A high voltage is at a trap capacitor when the antenna works to transmission. So it need a high voltage capacitor trap to be used at a trap. Such capacitor is costly and rather rare. Hams often use a length of a coaxial cable instead of a high-voltage capacitor. A 50- 0hm coax has near 100-pF/meter, a 75-0hm coax has near 70-pF/meter. Coaxial cable capacity can be find off from a data sheet for the coaxial cable or is metered practically. **Figure 6** shows a coaxial cable capacitor. For a capacitor with a small capacity (up to 30-pF) it is possible to use whole coaxial cable length, see **Figure 6A**. For a capacitor with a high capacity cut the coaxial cable on to several lengths, as it shown in **Figure 6B.**As a high-voltage capacitor in trap it is possible to use a bilateral PC-board by width of 1 to 3 millimeters. In this case capacitor get more bulky the made on coaxial cable basis. It is possible to tune the PC – capacitor on necessary capacity by slitting a foil on one of two sides of this capacitor. Do not forget about atmospheric protection of the trap capacitor.

Other way for trap design: It seems to me in the end of 70s in different radio amateur literature were appeared articles about using "coaxial cable trap" for W3DZZ. There is very simple method for trap making. **Figure 7** shows the trap. It is wise way for trap design, but radio amateur should have an experience using the method. In different radio amateur literature there are a lot of data for design of the trap, but classical methods are described at reference **[6]**.

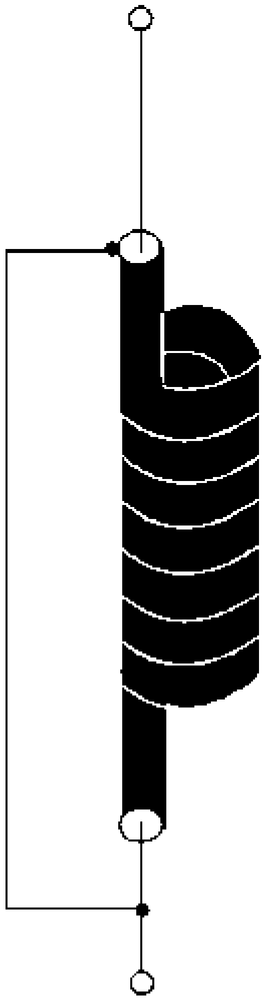


Figure 7 A coaxial cable trap

References:

1. By Alois Krischke : Rothammels Antennenbuch.- Franckh – Kosmos, V GmbH@Co., Stuttgart, 1995, 11 edition.
2. Jay Rusgrove, WA1LNQ: The Cheapie GP // QST, 1976, February, p31.
3. Morgan h. K. : Multifrequency Tuned Antenna System. - Electronics, vol. 13, August 1940, pp. 42-50.
4. Buchman C. L., W3DZZ : The multimatch Antenna System. // QST, March 1955, pp.22-23, 130.
5. The Radio Amateur's Handbook, 1970, by ARRL publication.
6. The ARRRL Antenna Book, 19 Editions // ARRL Amateur Radio, 2000.

A Five Bands Vertical Trap Antenna

M. Chirkov, UL7GCC

The classical **W3DZZ** antenna in vertical installation designed by UL7GCC and shown at the **Reference 1** is well known in Russia. **Figure 1** shows the antenna. Diameter of sections A and B is 40- 50-mm. How is it work?

40-m band: The trap LC cut out the upper section B from the antenna. So only section A works as a radiator, and the section A has length in 10.1 meters, i.e. has electrical length in 1/4λ. Vertical radiator having with the length of 1/4λ has a quarter- wave resonance and works in very effectively way. At the band the circuit LC works as a **trap**.

80-m band: On the 80-m band the antenna has summary physical length of this two sections A+B a little less than 1/4λ. A + B = 16.47 meters, less then 20 meters OF quarter wave length for the 80-m band. A short vertical radiator has a capacity part in its input impedance. But the circuit LC at the 80-m range has an inductance part in its impedance. The inductance part compensates capacity part of the electrically short vertical, and the antenna has a low SWR at the 80-m range too. In other words, the inductor of the LC works as a usual lengthening spool.

10-, 15- and 20-m ranges: Visa versa, at the 10-, 15-, and 20-m the LC has a capacity part at its impedance that goes the electrical length of the antenna to 1.75λ at 10-m, to 1.25λ at 15-m and to 0.75λ at 20-m.

Do not forget, verticals like counterpoises, so use several 1/4λ counterpoises for each bands.

Reference
M. Chirkov, UL7GCC: Multi range vertical // Radio #12, 1991, p. 21.

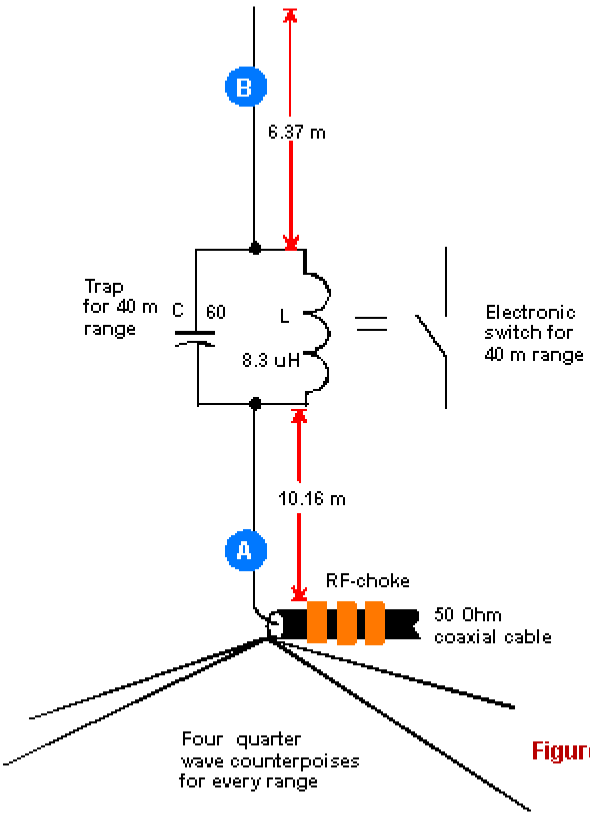


Figure 1

DIPOLE NADENENKO

Soviet radio amateurs well know the broadband dipole named in Russia “dipole Nadednenko.” The antenna is widely used at serve radio centers of Russia. Russian radio amateurs also are used the dipole. Below we take up a design of the antenna.

The dipole contains several wires at each shoulders shaped as a cylinder. Figure 1 shows the dipole Nadednenko. For working at 40- 10 meters the sizes are: L= 8 meters, L1= 3 meters, L2= 1 meter, 2R= 1 meter. Diameter of wires is 1.5- 3 millimeters.

Dipole struts can be both as metal as wooden. As usual, struts has the shape as a circle, wooden struts has the s polygon. Wires are attached to struts any possible way. ' ends of shoulders carefully are welded. As usual, a 300- wire line is used for feeding of the antenna. Antenna rad with horizon polarization.

By Radio 1959

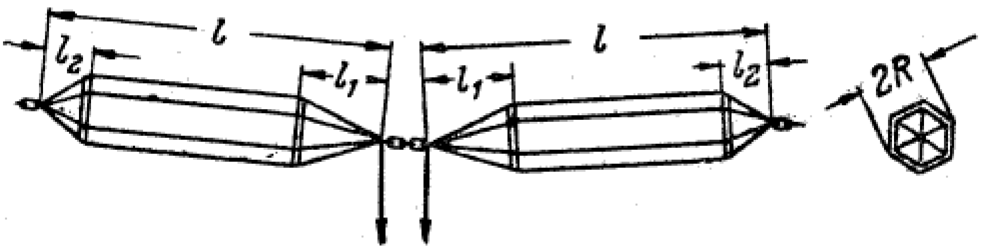
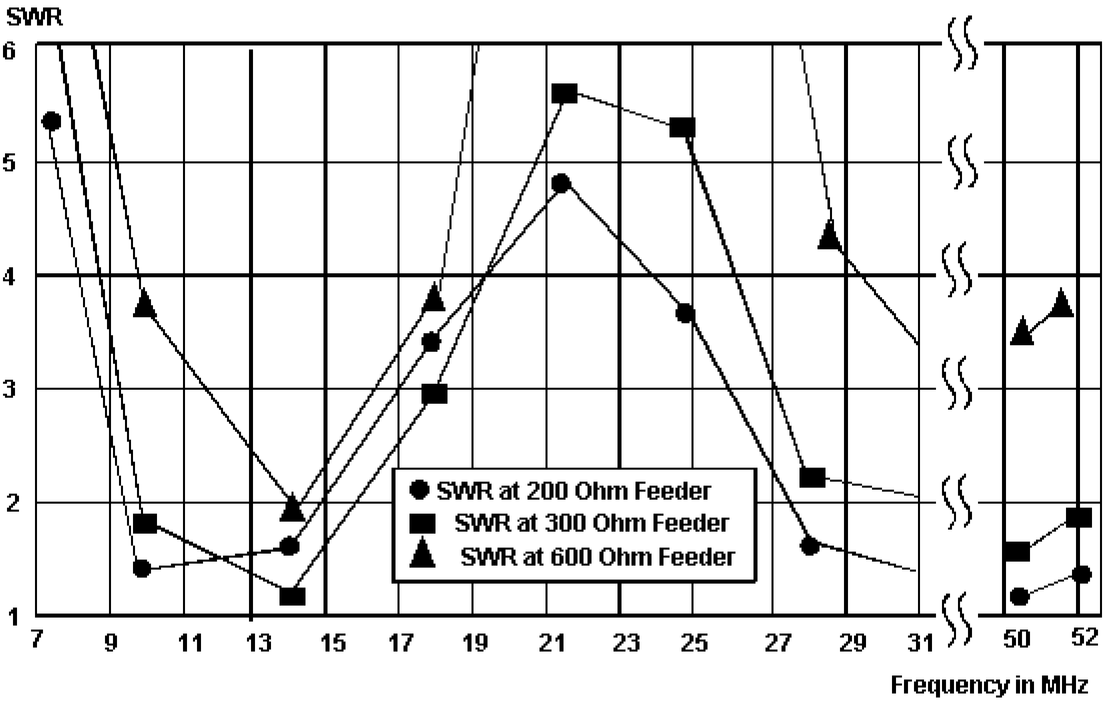
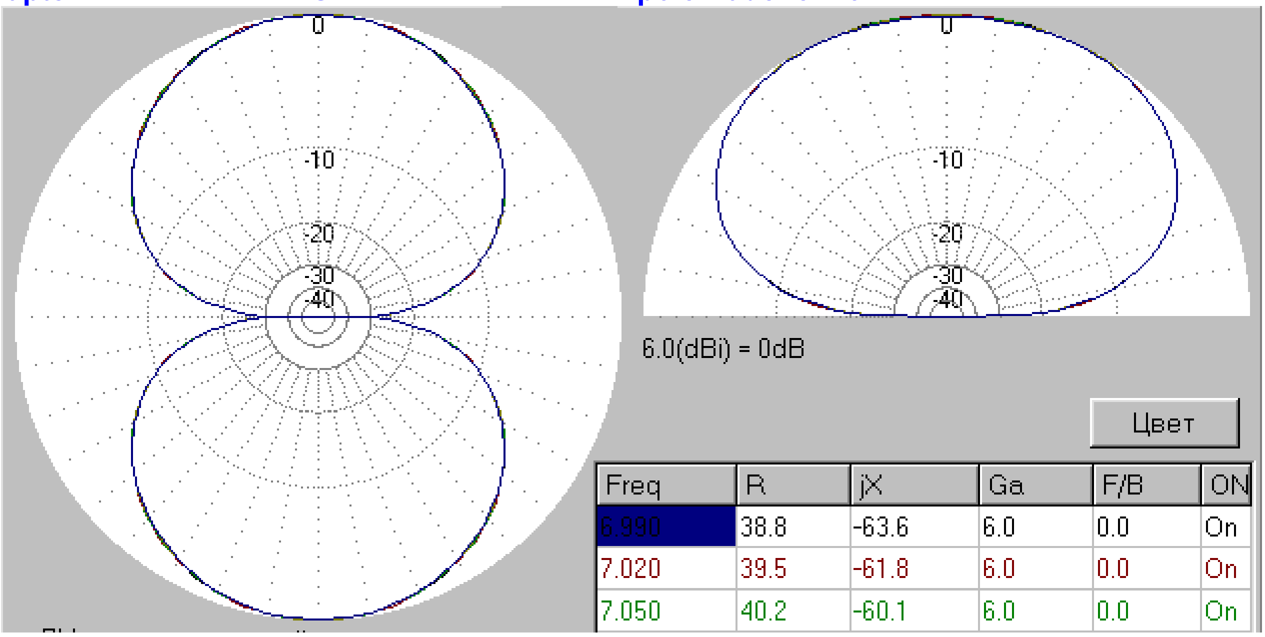


Figure 1

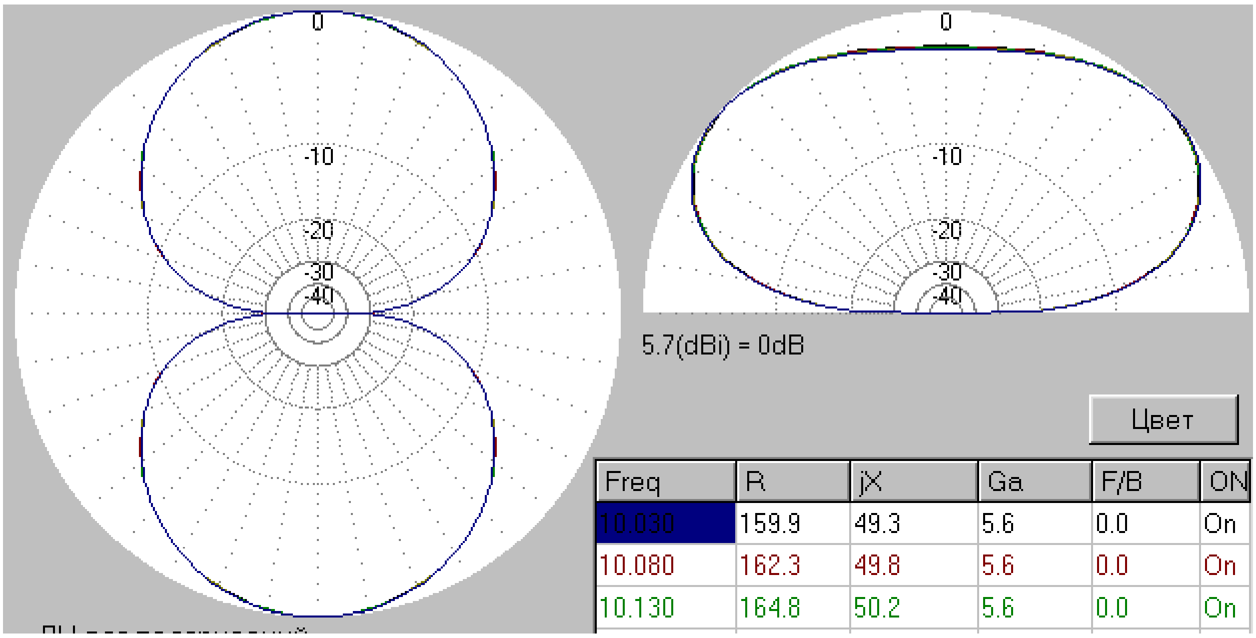
Calculations of input impedance and DD (***for horizon radiation***) of the dipole Nadenenko located at 10 meters above real ground with above mention dimensions (L= 8 meters, L1= 3 meters, L2= 1 meter, 2R= 1 meter, diameter of wires is 2 millimeters) are shown below. You can see, it is possible to use a 50-Ohm coaxial cable with a 1:4 transformer if restricted bands (30, 20, 10 and 6 meters) are used.

The data is obtained with help of a free antenna program MMANA (MININEC based). Left diagram is a section of the volumetric diagram directivity of plane X-Y at a zenith corner of the maximum radiation. The right diagram is section of the volumetric diagram directivity of plane X- Z. Also at the right down corner of the pictures is a table with antenna impedance.

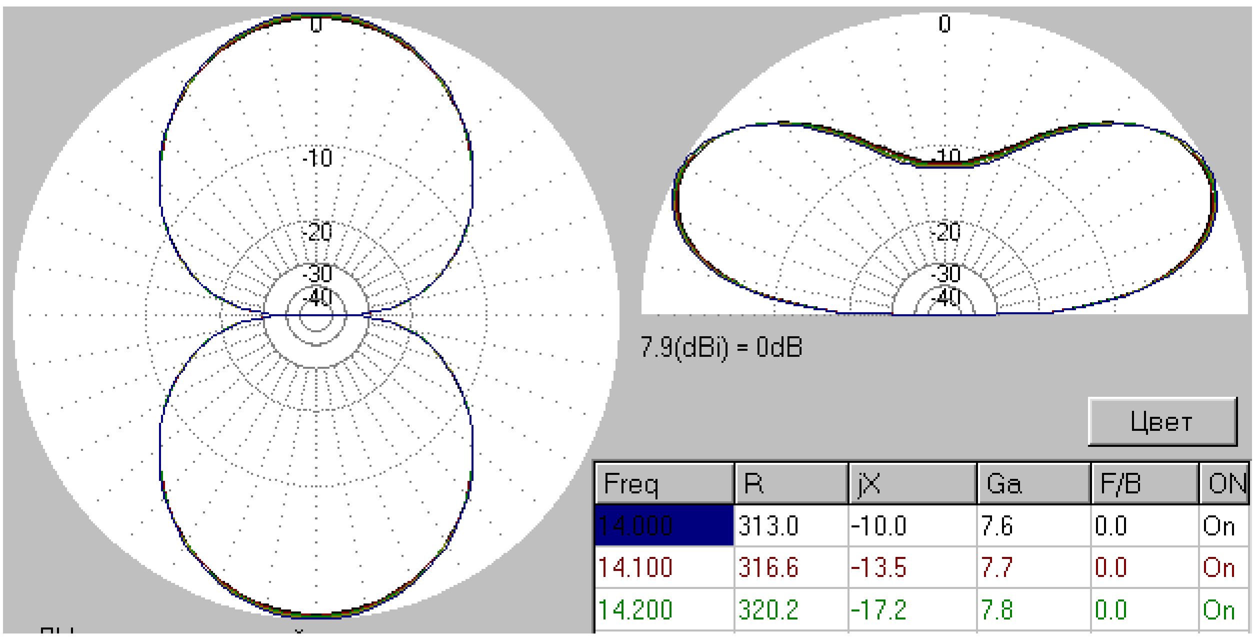




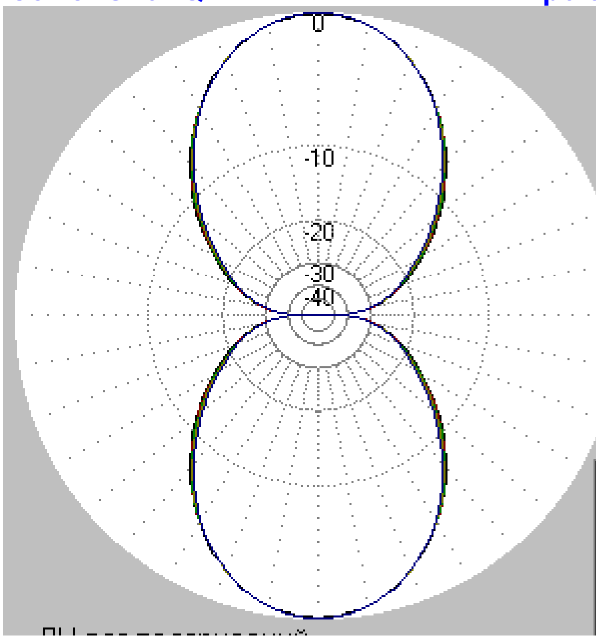
Freq	R	jX	Ga	F/B	ON
6.990	38.8	-63.6	6.0	0.0	On
7.020	39.5	-61.8	6.0	0.0	On
7.050	40.2	-60.1	6.0	0.0	On



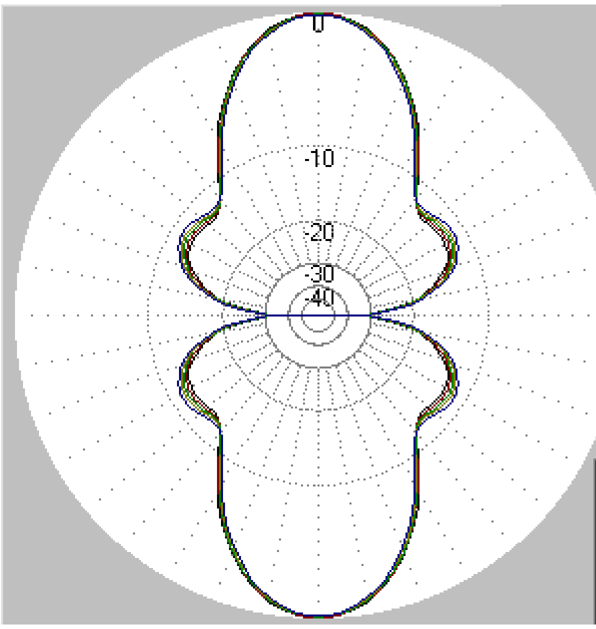
Freq	R	jX	Ga	F/B	ON
10.030	159.9	49.3	5.6	0.0	On
10.080	162.3	49.8	5.6	0.0	On
10.130	164.8	50.2	5.6	0.0	On



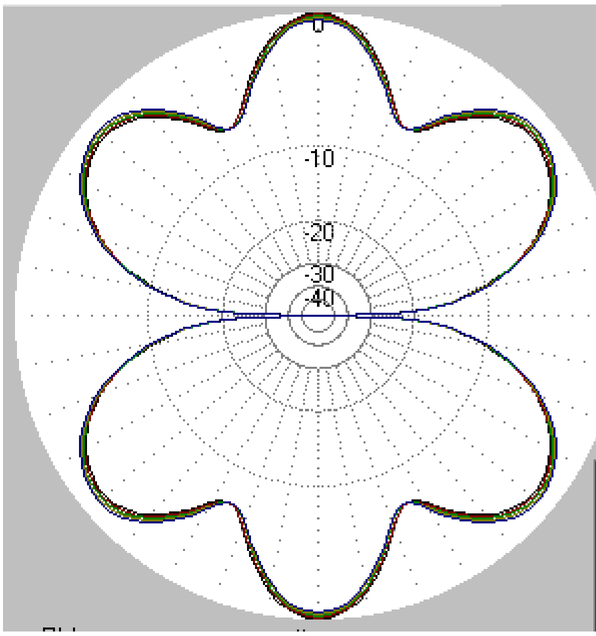
Freq	R	jX	Ga	F/B	ON
14.000	313.0	-10.0	7.6	0.0	On
14.100	316.6	-13.5	7.7	0.0	On
14.200	320.2	-17.2	7.8	0.0	On



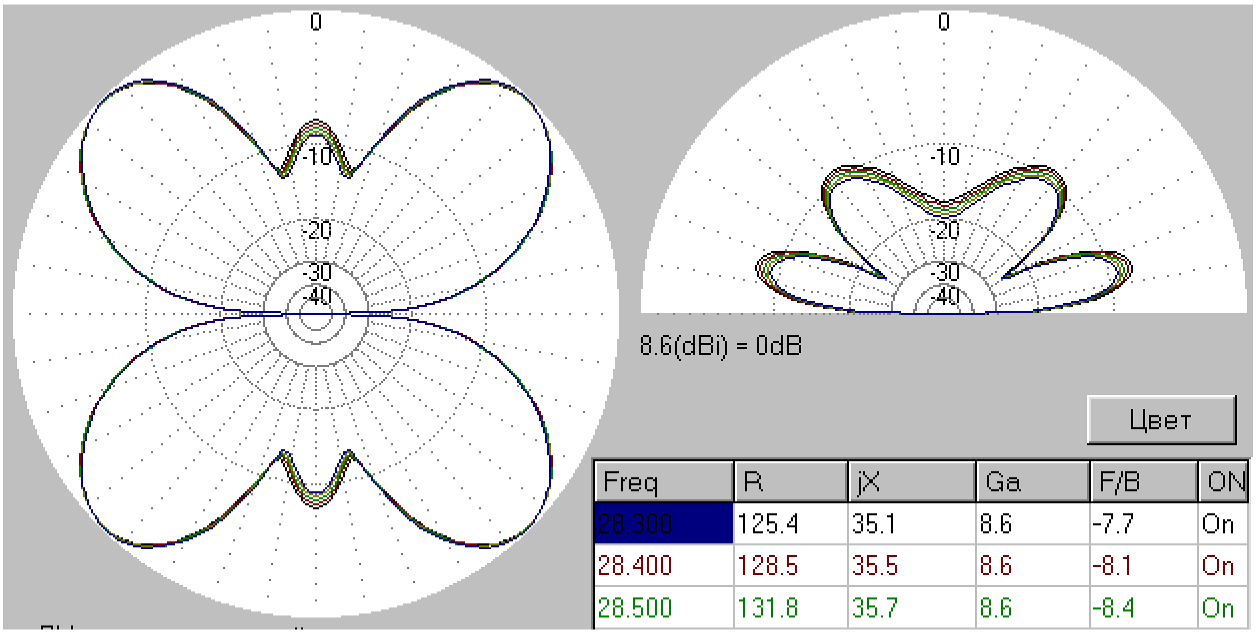
Freq	R	jX	Ga	F/B	ON
17.920	207.0	-260.7	10.1	0.0	On
18.020	197.5	-259.6	10.2	0.0	On
18.120	188.3	-257.9	10.2	0.0	On



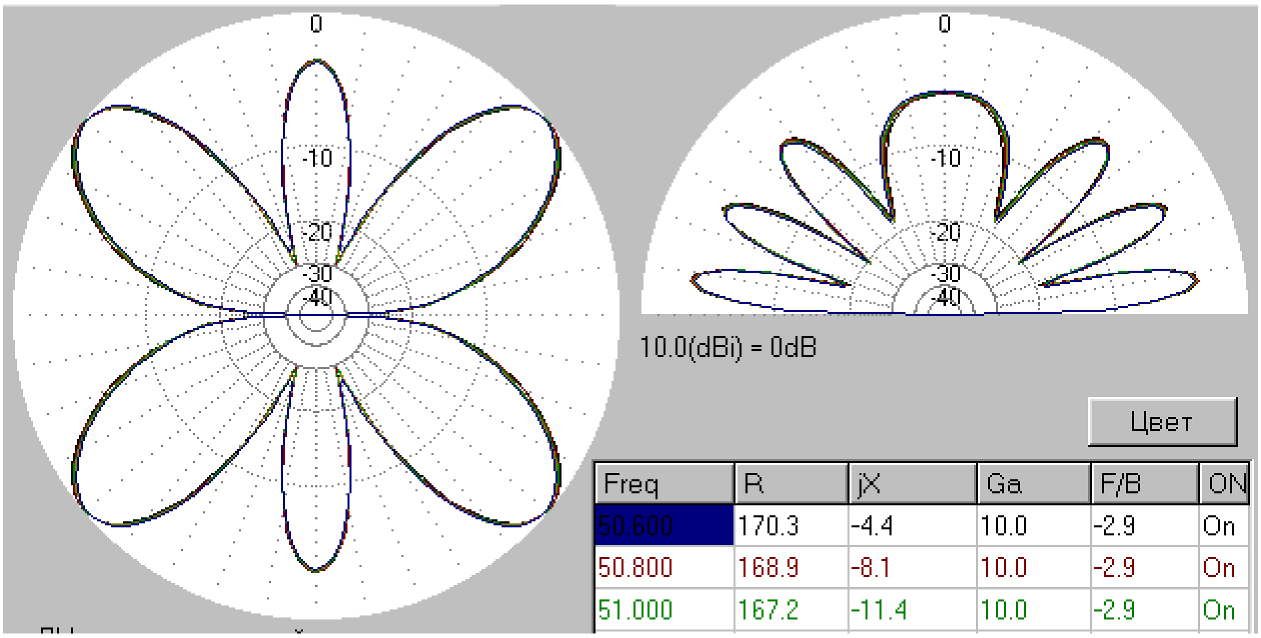
Freq	R	jX	Ga	F/B	ON
21.000	65.6	-147.5	9.9	0.0	On
21.100	64.2	-143.9	9.8	0.0	On
21.200	63.0	-140.4	9.8	0.0	On



Freq	R	jX	Ga	F/B	ON
24.740	56.0	-37.3	7.5	0.0	On
24.840	56.7	-34.7	7.4	0.0	On
24.940	57.4	-32.1	7.3	0.0	On



Freq	R	jX	Ga	F/B	ON
28.300	125.4	35.1	8.6	-7.7	On
28.400	128.5	35.5	8.6	-8.1	On
28.500	131.8	35.7	8.6	-8.4	On



Freq	R	jX	Ga	F/B	ON
50.600	170.3	-4.4	10.0	-2.9	On
50.800	168.9	-8.1	10.0	-2.9	On
51.000	167.2	-11.4	10.0	-2.9	On

Russian Military WW-II Radio "RBM"

Radio RBM is one of the most famous Russian military radio that was used in the WW-II and after the war as a surplus radio. RBM took place in the WW-II, after the war RBM was used as trial radio for military teaching centers. Lots of Russian hams know well the radio. I want to give some information about RBM and its antennas at ANTENTOP.

73! I.G.

History: Radio RBM, firstly named as RB (Radio, Base), was designed before the WW-II, in the 1938, in the Research Center of Communication of Red Army, by a special research group guided by colonel Sosunov. Special variant of RB named as RB-40, that had low weight because it was made in an aluminum cabinet was produced from end of 1939 for spy and partisan. It was made near 1000 RB-40, but then its producing was stopped because the aviation need aluminum. In the 1942 some modifications were done in the radio, and RB was named as RBM (Radio, Base, Modified). In the 1943 both with RBM was produced RBM-5 that has 5 watts power compare to 1 watt that RBM has. After WW-II other modification of RBM named as RBM- 1 was produced. RBM-1 was produced until end of 50s. Some samples of RBM-1 was produced for export (***see picture with Latin letters on the front panel***).

Composition: RBM –1 consists of from two boxes, one is the transceiver other is its supply unit.

Transceiver has dimension of 345x195x260-mm, weight of 13 KG. It works at two frequency ranges, I- 5.0- 2.75 MHz, II - 2.75-1.5 MHZ, has CW and AM modes. Transmitter made on vacuum tubes

Transmitter has 1 watt output(in reality 1.5 watts), plate current 35-mA and heater current 1-A.

Receiver has sensitivity of 10-μV at AM and 3-μV at CW, plate current 10-mA and heater current 0.5-A.
Transmitter and receiver use common units as: an antenna and output audio transformer, that does modulation for transmitter at AM mode and audio at receiving mode.

Power supply has three batteries of BAS-80 for plate and a NiCad accumulator 2NCN-24 for heater, weight of 14 KG. The Power Supply run the radio during 24- 36 hours.

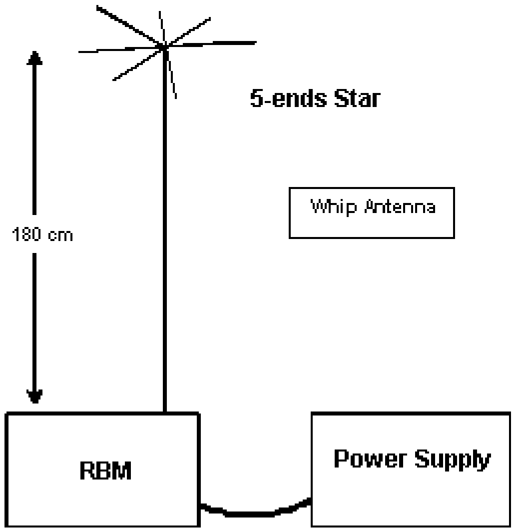
Purpose of RBM is to do reliable simplex communication at any conditions. Distance of the communication depends on antennas that use with the radio.

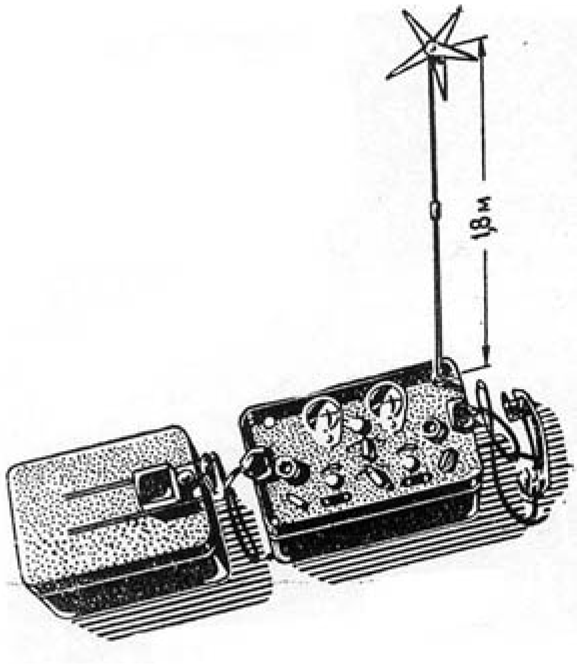
WW- II. USSR, Leningrad Front, 1943. Radio RB

Export Sample of RBM-1

RBM Radio

Short Whip Antenna does communication near 10 kms on AM and near 15 kms on CW.

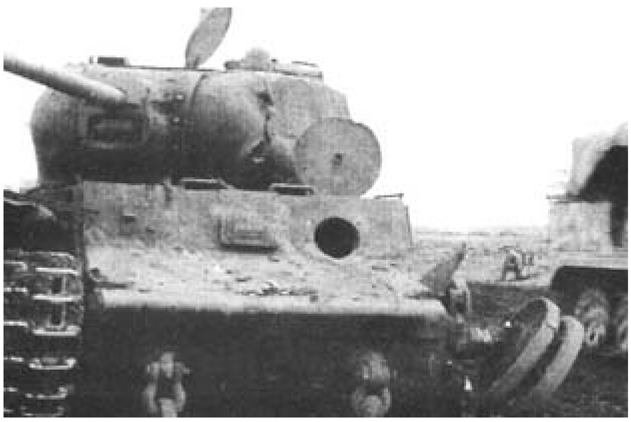




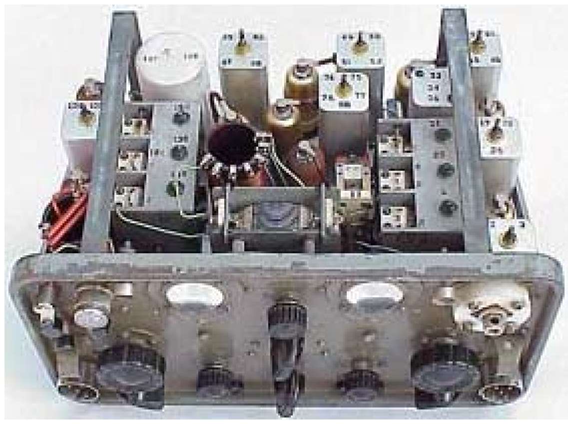
I live near village Prohorovka, Russia, where at July-4- August 5, 1943, The greatest tank battle of WW - II was. As I know, near 500 samples of RB radio took place in the battle

German tank Elefand/Ferdinand
Destroyed by a tank mine.
Prohorovka, July, 1943

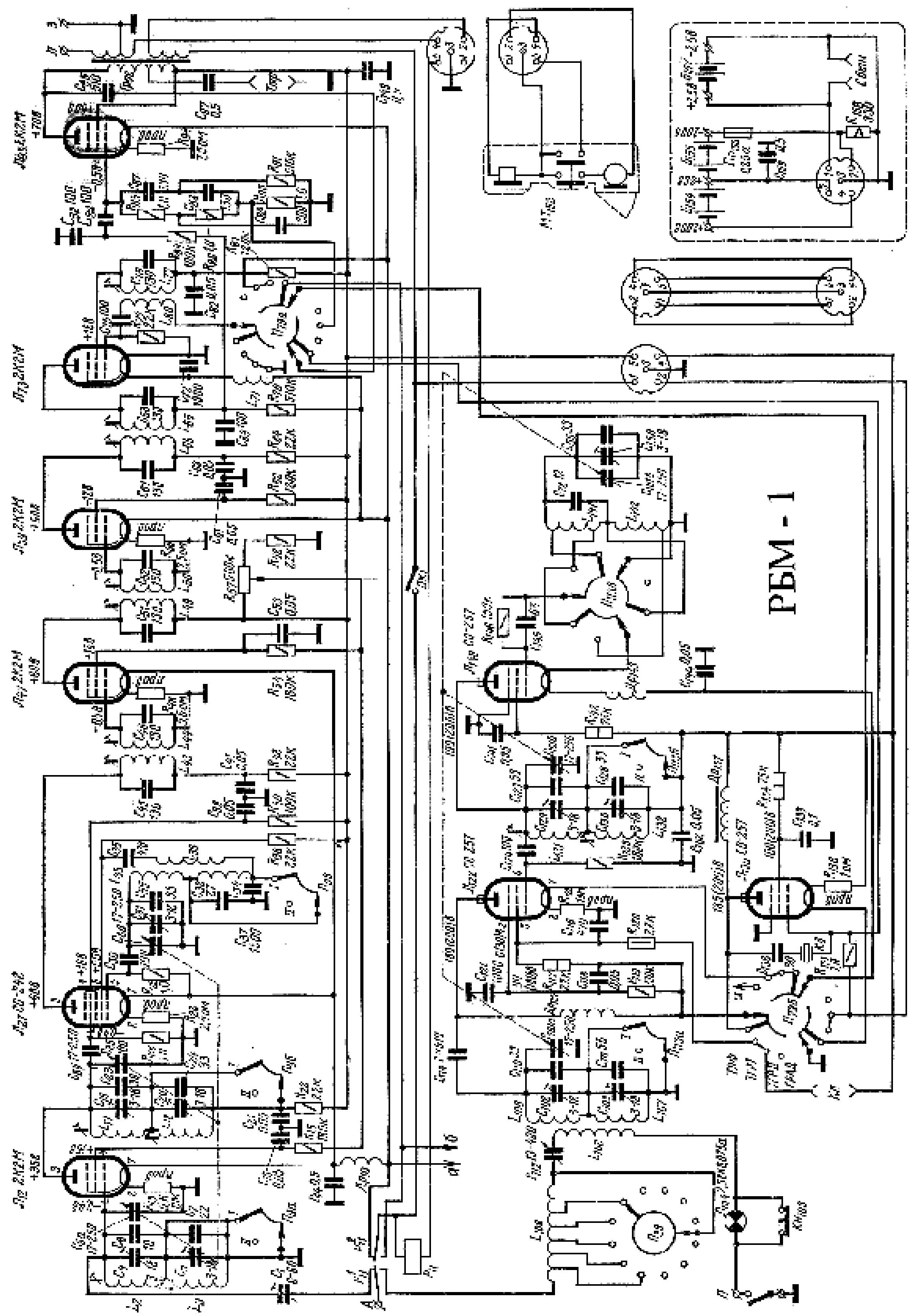
USSR tank KV-1
Destroyed by a German tank Tiger.
Prohorovka, July, 1943



Russian RBM-1



Schematic of RBM-1

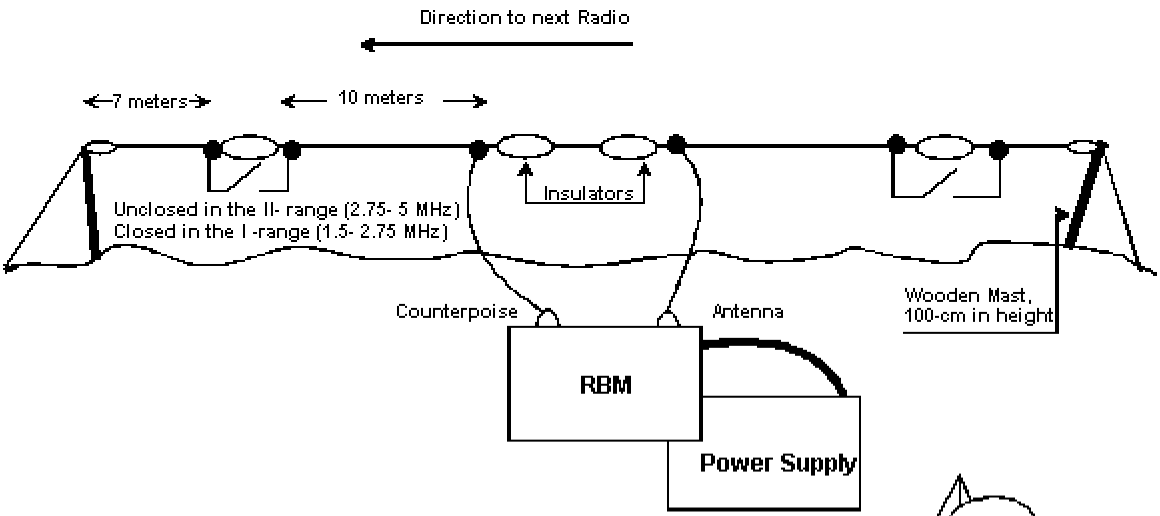


Ground Dipole Antenna does communication near 17 kms on AM and near 35 kms on CW.

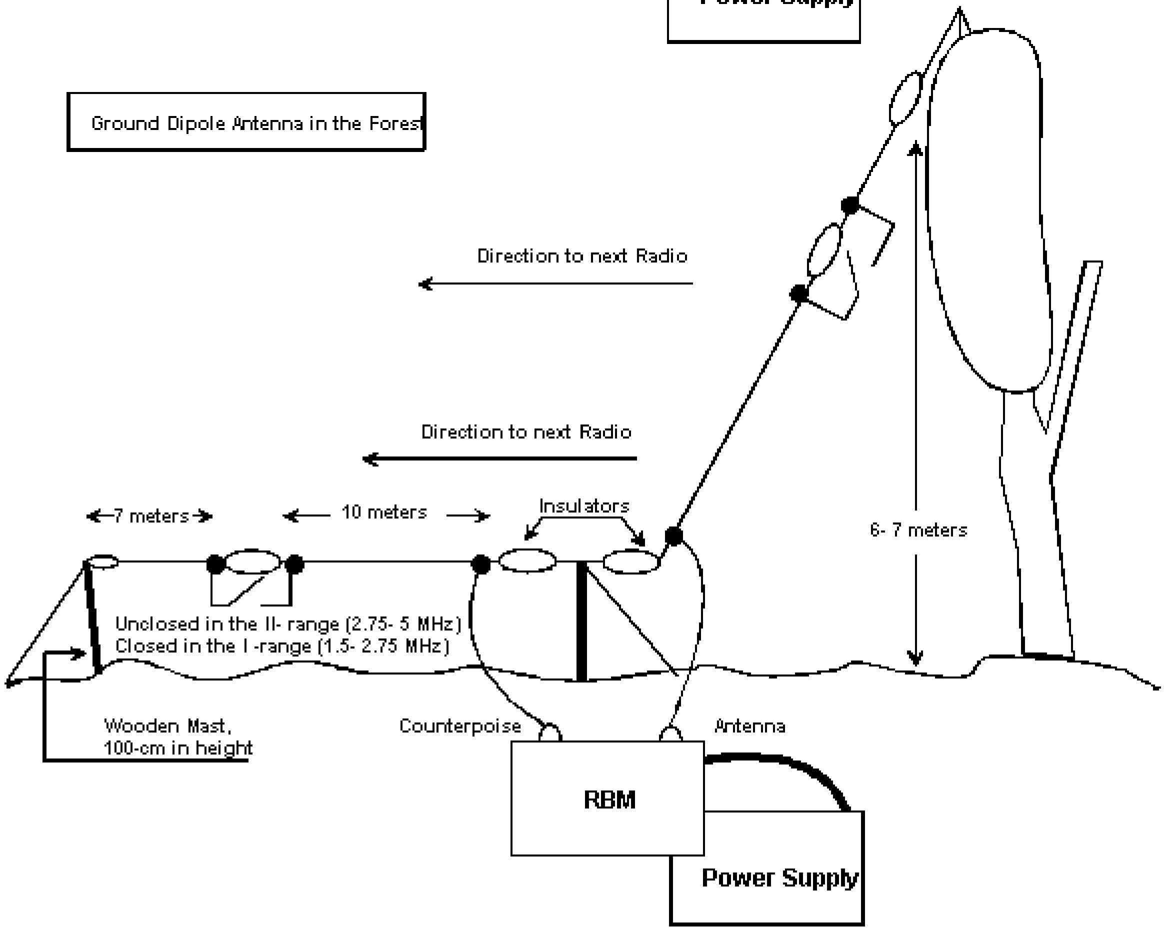
Mast Antenna does communication near 30 kms on AM and near 50 kms on CW.

Note: The distance of communication is shown for daytime at middle level of interferences. At nighttime and at high level of interferences the distance of communication is decreased in two times.

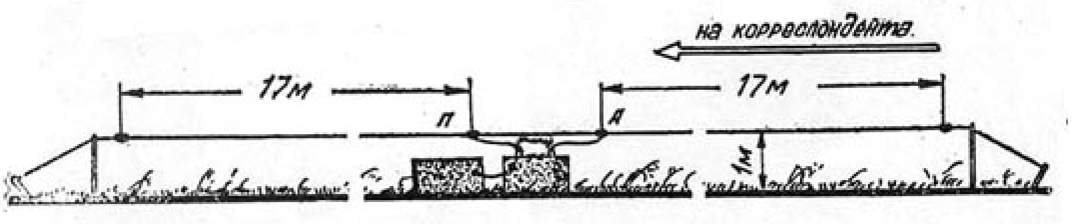
Ground Dipole Antenna in the Field



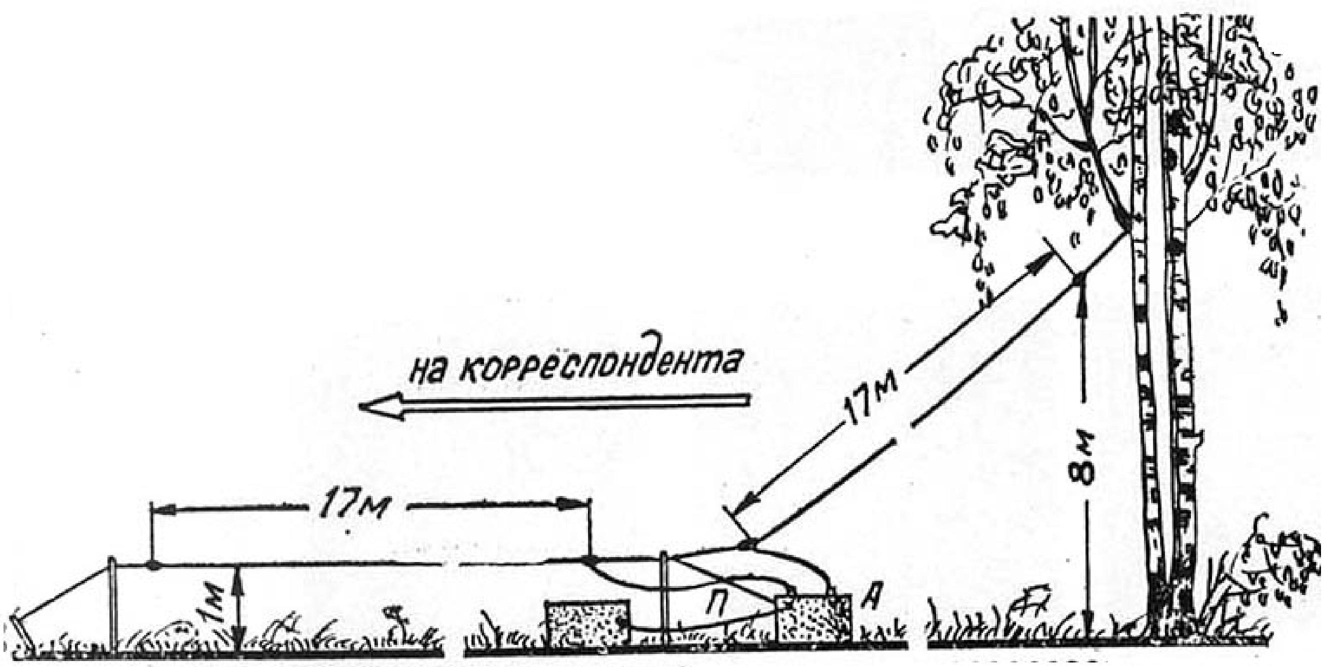
Ground Dipole Antenna in the Forest



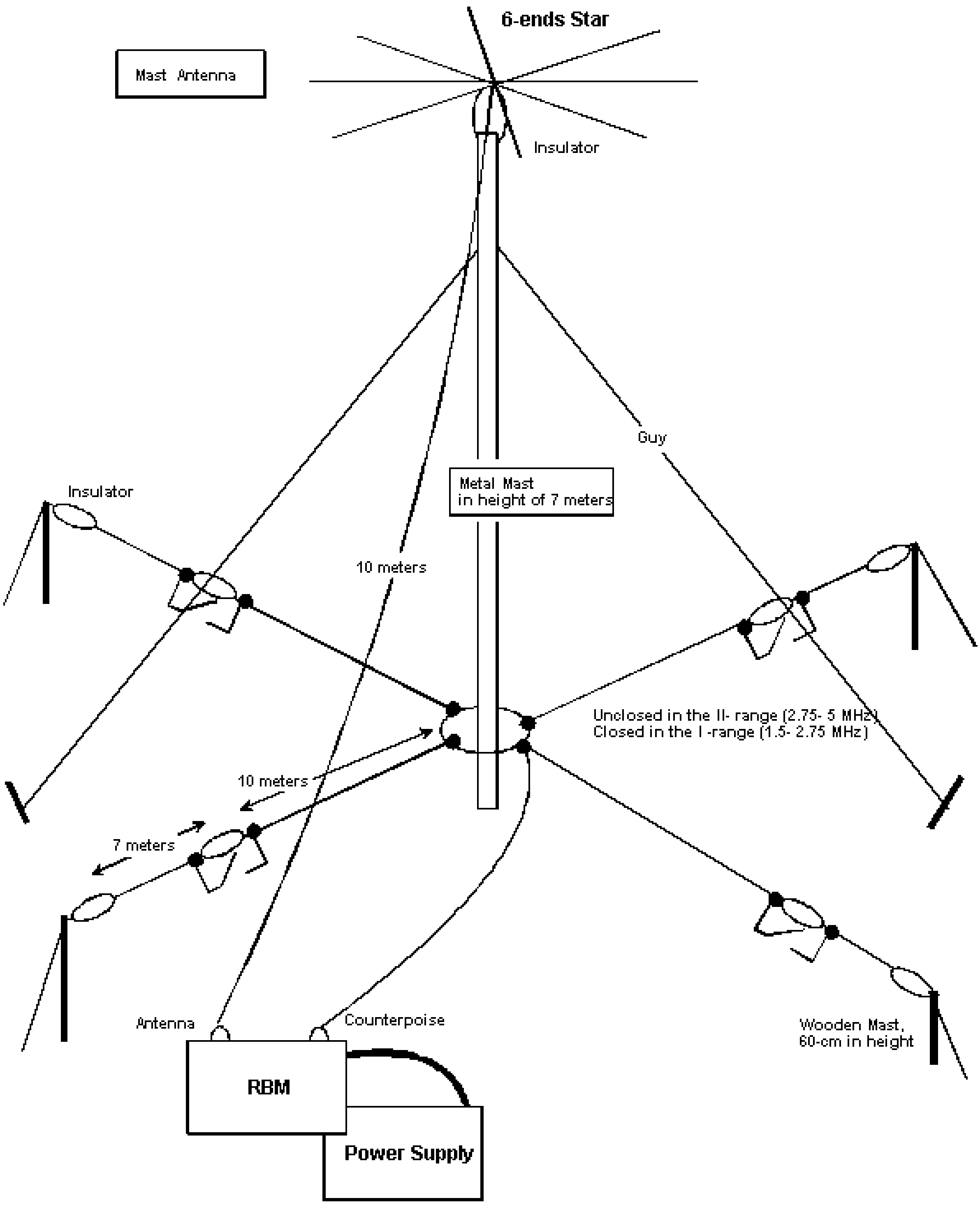
Picture from Russian Manual



Picture from Russian Manual



Winter, 60s, XX- century, Russia



Credit Line:

Radio Magazine, USSR

RBM Padio. Manual for user. 1952.

http://www.cqham.ru/

http://www.oldradio.onego.ru/

http://www.battlefield.ru/

HALF - LOOP ANTENNAS
FOR HF COMMUNICATIONS IN ALE AND FREQUENCY HOPING

Jean-Pierre GOUIN & Daniel LAFARGUE

In France

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means
ANTENNAS

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The present describes a HF loop antenna and its agile coupler which can be adapted to the new designs of ALE and FH (frequency hopping) radiosets. The original specification in 1993 was : "a small mobile antenna and coupler for HF voice and data communications in driving from 0 to 600 km without silent zone, in association with a 125 Watts CW radioset.

Frequency range 2-12 MHz Channel tuning time < 5ms Bandwidth > 3,5 kHz in a military environment" Following on from this product other versions with wider frequency range (3-15 MHz, 3-30 MHz, 2-30 MHz), a higher power and various dimensions and shapes for fixed, land-mobile and naval applications have been developed.

1. GENERALITIES

1.1. on the HF tuned loops

The HF transmission tuned loop antennas which are designed for HF transmission have small dimensions (< 0,1λ) compared to the wavelength, in order to conduct a quasi constant current and to be considered as magnetic dipoles. Their radiation impedance and efficiency mainly depends on their surface which creates a magnetic flux in the near field and an electromagnetic field in the far field. Their diameter, height or width (round or square shape) run from 1 to 3 meters, and their radiating surface generally do not exceed 5 m^2 in order to coincide with the small dimensions required.

These types of antennas differ from open antennas (like whips, horizontal dipoles, log-periodic antennas,) by their impedance which is reactive and can be adapted by capacitor only. Their radiating resistance is low (< 1 mΩ) at the lowest frequencies of the range. As the efficiency is given by the ratio radiating resistance/ total resistances of the tuned circuit, it is necessary to minimise the radiating element resistor, using a good conductive metal (aluminium, copper), and to use low loss capacitors.

These conditions beeing fulfilled, the loop antennas deliver a high current and have a high selectivity with a high quality factor (Q-factor), typically 10 times higher than the Q-factor of the best traditional couplers designed for 5 to 10 meters whips or 10 to 40 m dipoles.

1.2 On fast frequency tuning

For future fast ALE procedures the tuning target time is 50ms, while the "low speed" frequency hopping (F.H.) procedures already require a 5ms tuning time, with all calculations and control exchange times beeing included or already done. This can't be done using electromechanical tuning. Digital switching devices are cost effective today at low and medium powers. Their switching time run in milliseconds using low loss vacuum relays, and in the microseconds using electronic relays like PIN-diodes. But the PIN-diode technology cannot be used in loops for transmission, due to their inability to withstand the high currents and due to the losses they bring (0.5 to 1 W) which would drastically decrease the overall efficiency at the lowest frequencies. Vacuum relays, including REED relays, are the only technologies available to switch the capacitors of a transmission tuned loop antenna efficiently.

1.3 On the power requirements

Based on the experience of 2 previous generations of tuned loop antennas, and the proprietary propagation simulations, it was calculated that two 100W radiosets and 4m^2 loops having a -15 to + 5dBi typical gain figure from 2 to 12 MHz would insure voice and data communications at any distance from 0 to to 600 km at least.

This mission cannot be fulfiled by any 5 to 10 m whip antenna on a medium soil, even in association with a 400W/1 kW radio set: a vertical whip or a bent whip on a vehicle in move do not transmit and receive enough energy to cover the typical 50-250 km silent zone.

A 125W radioset combined with a tuned loop antenna is sufficient to fulfill the mission requirement using the Near Vertical Incident Signal (NVIS propagation). This will be further improved due to frequency management and the new generations of HF modems which will bring a lower threshold of sensibility.

II DEVELOPMENT OF A NEW MOBILE TUNED FRAME ANTENNA

II.1 Principle

The mobile tuned loop antenna is a "half-loop" set-up vertically on a metal surface which achieves a full loop equivalence. The metal surface like a mobile platform (truck or shelter, ship's cabin,...) must have a good electrical continuity. Thie half-loop is half the size of a full loop and makes installation possible on small vehicles on the move.

The half-loop is folded and joined at each end to the platform's earth. One end is loaded by a variable capacitor.

A feed rod ("the feed coil") links the radioset RF access to a precise point of the half-loop. It is equivalent to a fixed reactive element, and the whole system acts as a loss-free autotransformer whose primary circuit can be set to 50 W.

II.2 Modelisation of the antenna

The modelisation purpose is the definition of the electrical circuit and the parameters of the antenna. It is made by the wire methods of moments.

The radiating element is represented by a radiating impedance (Rr, La) with a loss resistance Rp

The tuning capacitor is represented by a serial circuit (C, Rc), C being the capacitor value and Rr its loss resistance.

The 50Ω matching is figured by a loss-free transformer M with a matching ratio K, and a parallel or serial inductance L at the RF input.

Establishment of the equivalent circuit parameters:

-The radiating element (Rr, La) is calculated by an electromagnetism software based upon the method of moments.

- The radiating element loss Rp is determined according to the antenna material and section

- The capacitor's losses Rc are determined through the manufacturer's data

- The matching ratio K is a function of the primary to secondary radiating surface ratio

- The inductance L is a function of the spiral surface comprised between the feed bar and the platform.

Two types of antennas have been compared, type A and type B, differing by the positions of their capacitors.

II.3. Modelisation of the antenna type A

The capacitor is positioned in the secondary of the transformer, at the end of the line (**FIG 1**).

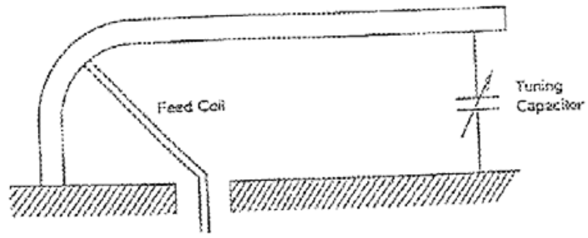


Figure 1

The electrical equivalent sheme is given **FIG 2**

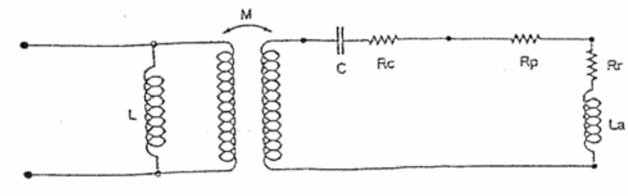


Figure 2

The results are computed by a specific C.A.D. radiofrequency device and compared to the values measured on full scale antenna mock-up.

As an example, **FIG 3**, **FIG 4**, **FIG 5** show the

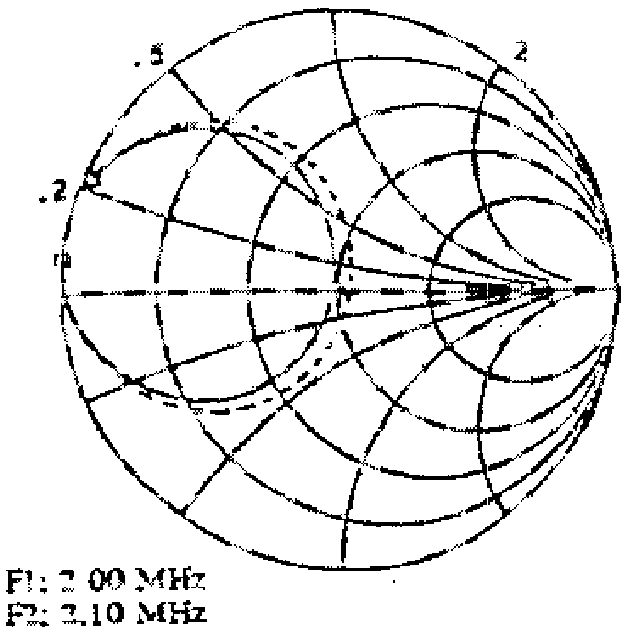


Figure 3

impedances at various frequencies on the Smith charts, with computed values (in full line) and measured values (in doted lines). These charts underscore the performances of a resonating cavity like a R, L, C parallel device, and confirm the impedance values computed by the method of moments.

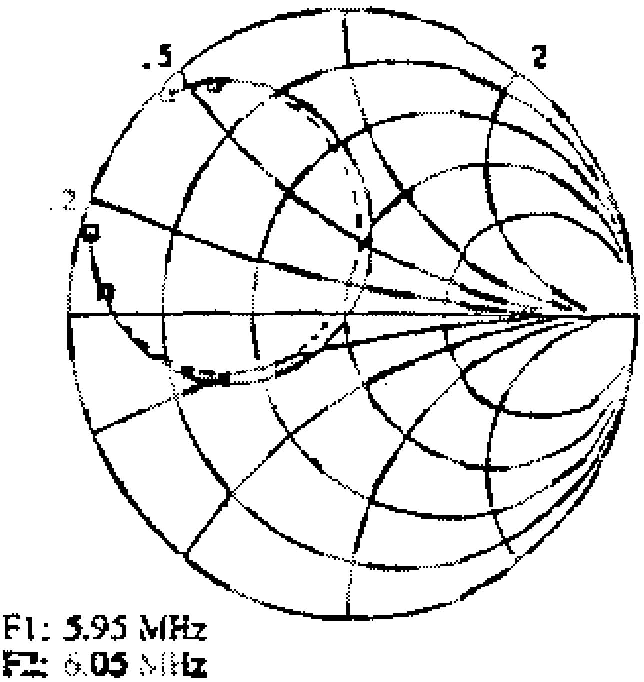


Figure 4

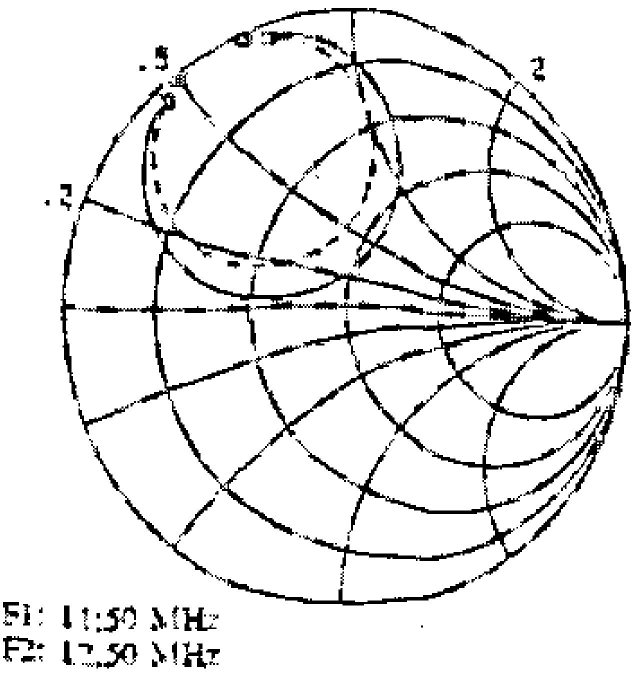


Figure 5

The calculated and measured values are compared at various frequencies (**FIG 6**, **FIG7**) The bandwidth is measured at VSWR ý 2.5:1 , when the real and the imaginary terms of the impedance are equal.

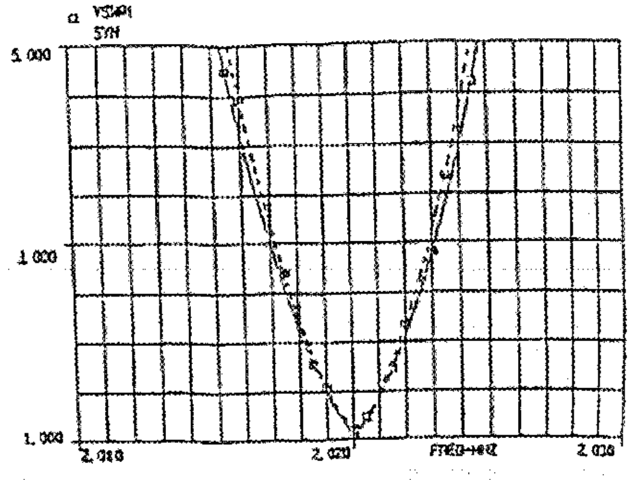


Figure 6

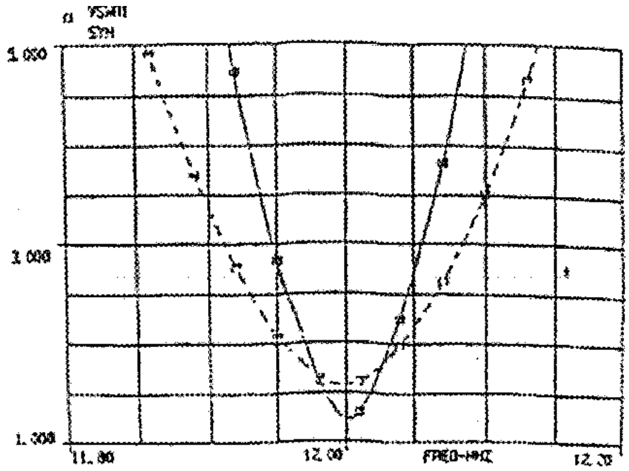


Figure 7

The results have validated the antenna equivalent circuit.

This sheme helped to optimize the dimensions of the radiating element, considering the efficiency and bandwidth requirements. The approximative values are, from 2 to 12 MHz:

Rr = 0,5mΩ to 3 Ωwith a 2,2m^2 antenna surface

Rp= 0.01 to 0.02 Ω

C= 3500 to 60 pF

Rc= 0.05 to 2 Ω

The equivalent circuit aided in the calculation of the voltages and the currents developed over each electronic component.

II. 4. Modelisation of the antenna type B

The tuning capacitor is positioned in the primary of the autotransformer (**FIG 8**).

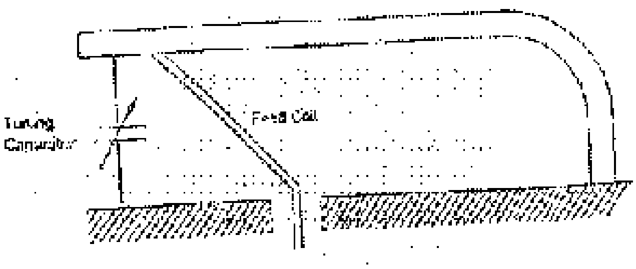


Figure 8

Its equivalent electrical scheme is given on **FIG 9**.

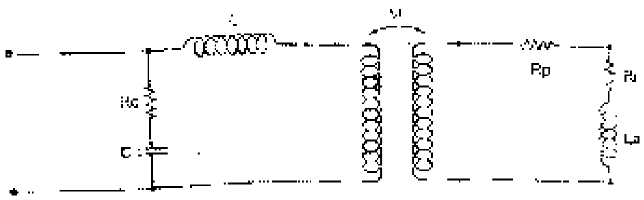


Figure 9

The Type B antenna is modeled in the same way as the Type A antenna, and using the same physical parameters. An additional capacitor may be added in the feed rod to optimize the radioset matching impedance.

II.5. Compared performances type A and type B antennas

Comparative simulations

The compared simulations gave a clear advantage to the Type A antenna type. As an example, **FIG 10** shows a +12 dB gain advantage for the Type A antenna at 12 MHz

Comparative measurements

The comparative simulated results were confirmed by the comparative measured bandwidths Using 2 antennas having the same radiating surface, the compared measured bandwidths were 5 to 10 times

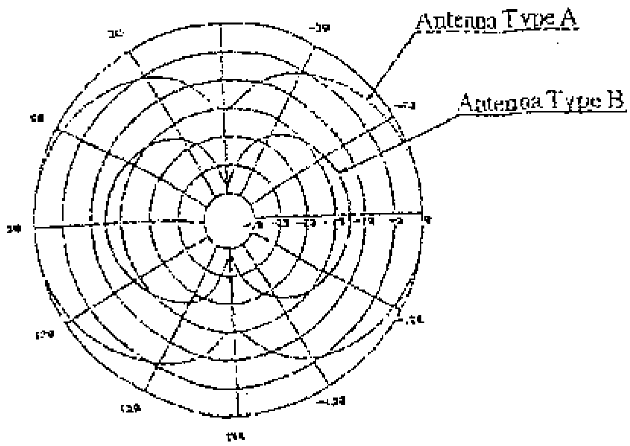


Figure 10

higher for the Type B than for the Type A antenna. In a tuned circuit, bandwidths (B) are inversely proportional to the quality factor (Q), and Q is proportional to the efficiency (h); when Q >> 1, h x B = Rr/2p La = constant If ha and hb are the Type A and Type B antenna efficiencies , and Ba et Bb their bandwidths respectively, the applying formulas are ha Ba = hb Bb, and ha / hb = Bb / Ba When the measured bandwidth ratios is Bb / Ba = 10 , the efficiency ratio becomes ha/hb is 10.

Explanation

Observing that Type B antenna optimizes the tuning in the primary circuit, and that the Q-factors of primary and secondary are quite different, the energy transfer in the secondary is not maximized. On the contrary, in the Type A antenna the tuning brings a maximum Q-factor and the current is the highest in the radiating resistor.

Conclusion

The Type A antenna design brings the best antenna efficiency.

II.6 Improvement of the design

Increasing the bandwith

Trials on vehicles were made under strong rain. Modifications of the tune positions were observed at the highest frequencies (**FIG 11**)

Such modifications can give an operational problem with no possible reset in transmission (in FH mode principally).

This shifting problem was resolved by widening the bandwidth by using two radiating elements in parallel and electrically linked. The simulation of this structure

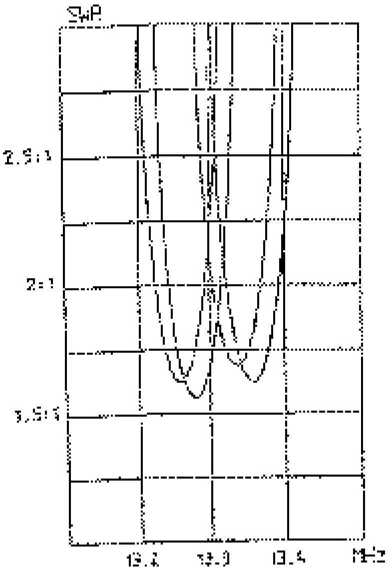


Figure 11

modification concluded in a +10 to +15% extended bandwidths and in +0.5dB to +1dB extra efficiencies all over the frequency range.

II.7. Realisation of a fast tune design

The 2-12 MHz.antenna was developed for the required efficiency and a minimum 3.5 kHz bandwidth independently of the variations in the environment.

With a 2.2m^2 radiating surface the half-loop reactance is 2mH at 2 MHz and 3.5mH at 12 MHz.

The tuning principle consists in switching capacitors in parallel to create a series of bandwidths with mutual covering at a VSWR < 2.5:1.(**FIG 12**)

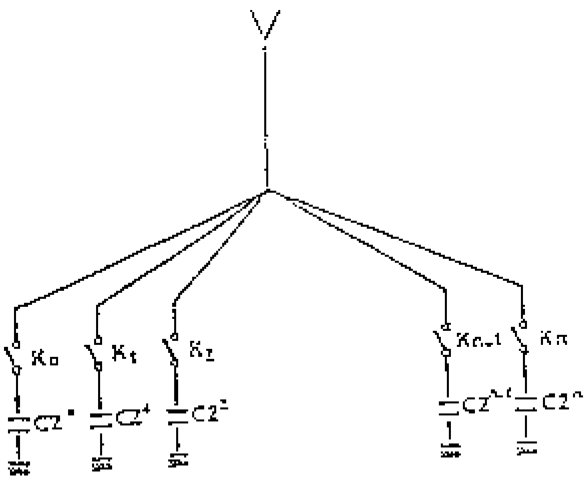


Figure 12

Principle of the capacitor switching

The capacitors which are necessary to tune the antenna reactance are scaled from 3300pF to 60 pF at 2 MHz and 12 MHz respectfully, with a 1,5 pF accuracy at the highest frequencies.

A logarithmic series of n switchable capacitors in parallel defined by Ci=2 Ci-1 with C1=1.5 pF give all discrete value multiple of 1,5pF:

C = S ki Ci from i = 1 to n , with ki= 0 ou 1

C1, which is the smallest used capacitor, defines the accuracy of the C capacitor

The highest individual capacitor value is in theory 3300/2=1650 pF in order to get 3300pF by the addition of all capacitors, and n must be higher than 10.

The total number of capacitors is choosen equal to 12 to takto into consideration the dispersion of the components whose values are guaranteed with a ñ 5% precision, and to recover the possible missing frequency bands.

A special software was created to define and memorize the kiCi arrangements which are necessary to get all discrete capacitor values and recover the possible missing frequency bands. It memorizes the calculated values and the measured values. A calibration at the first installation or in operation in case of a major environment change can be done in less than 6 seconds.

Measured results

The prototype of the antenna achieved a VSWR 2.5:1.

Typical figures are given **FIG13**.

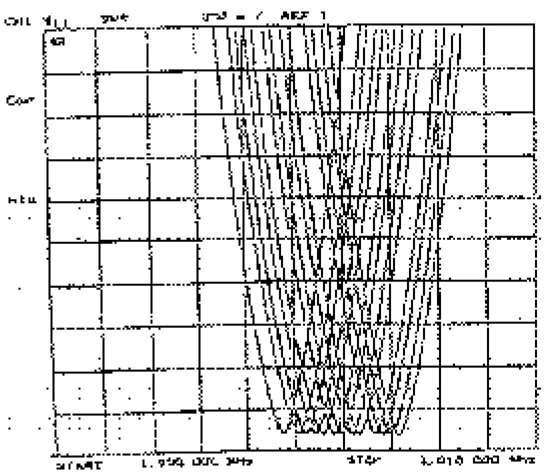


Figure 13

II.7. Qualification

A 2-12 MHz demonstrator was built with acceptable dimensions for land mobile applications (height=90cm, length=2.4m, width=30cm). All adjacent bandwidths were covered within the 2.5:1 VSWR specification.

Its efficiency was measured every 0.5 MHz on a test station by substitution of a refence whip. These values were not more different than ñ1dB from the values deducted from the Q-factor measurements.

A second version with a 2-30MHz frequency range was developped. It was qualified for military environment with mechanical tests (chocks, vibrations) and climatic tests (-40C +70C, rainfall, salted fog, windspeed, ice, dusts, etc...) according to MIL SPEC standards. It is now in service in quantities in the French Army.

III FIELD TRIALS

Extract from the field trial made by Thomson-CSF in octobre 1994 for the French Army:

"From 0 to 600 km, all Q/S and S+N/N measurements have confirmed a behaviour without fault of the half-loop. It always gave results much higher than that of the guyed 5m whip whatever the climatic conditions were (rain, intensive fog...). We tried to use the station in the most extreme environment conditions noting the link results, while driving under the rain, under the high voltage cables either parallel or perpendicular to the road, measuring signal/noise in highly industrialized towns (like Clermont Ferrand) , on the country roads through humid forests, etc...

"The results were independant of these environmental conditions, the reception signal/noise beeing only slightly affected under the very high voltage cables.

"...The half-loop antenna bring the best results in terms of link budget and listening comfort".

Thomson-CSF also confirmed that the half-loop antenna on a moving car allows fast data transmissions without fault in the silent zone of the whip antenna, and that it improves the probability of successfull synchronisation of the new procedures in bad ionospheric conditions.

Other field trials were successfully conducted in France and several foreign countries in the Middle East and America.

IV RADIO INTERFACES

Mobile and naval half-loop antennas and fixed/semi-fixed loop antennas using the same electronic components and softwares are working today with various radiosets for military and civilian applications as well, in frequency hopping, ALE or fixed frequency modes A modular and universal interfacing unit makes it possible to fit the antenna at the radioset RF output using the control interfacing designed for its antenna coupler.

The control exchanges can be done in RS232 or multiwire cable according to the speed. The frequencies can be provided in clear, as a channel number or not provided at all. A frequency counter is necessary in this last configuration.

(Continue on the next page)

MILITARY TACTICAL ANTENNAS

STAREC has been involved for a long time in the design of specialized antennas, a wide range.of which has been proved in operation with French and foreign Armed Forces.

This equipment is mainly used in fixed or mobile weapons or telecommunication systems, such as shelters, trucks, battle tanks, forward armoured vehicles, etc. STAREC is involved in the RITA, ROLAND, PR4 G, HF Carthage programs.

Agile half loop on vehicle

http://perso.wanadoo.fr/starec

V APPLICATIONS

The chart below present the "not so wellknown" specificities and applications of the HF tuned HF/125W loops and half-loops.

GENERAL CHARACTERISTICS	APPLICATIONS
Very small dimensions for HF (1.5 to 3m rectangle or diameter) Can be radomed	Difficult installations (on roof, small areas, ship,...) Half-loop capability to communicate from a moving vehicle. Discrete stations (fixed and mobile)
Small surface on ground.A ground plane is not necessary for loop	Easy and low cost installation.
Low take-off angle propagation andGround wave radiation (8-shaped pattern)+Near Vertical Incidence Skywave (NVIS) Directivity: + 2dB in free space and +5dB or +6 dB on a conductive ground Gain: - 12/-15 dBi at lowest frequencies to+ 2/+ 5 dBi at highest frequencies.	Communications up to 1000km with 125W, without silent zone in azimuth nor petal nulls in elevation. Communications of the ships along the coasts and over mountains. One antenna only gives the equivalent services of a NVIS antenna (like horizontal dipole) and a vertical whip (at longer ranges). Achievement of an ALE fully automated mobile station: no more need to change antennas at halt alongside the classic silent zone of whips.
High selectivity in the lowest range. High reduction of outband transmissions. High reduction of received noise and improvement of the Signal/Noise ratio(typically 6 to 10dB in reception compared to the wider band antennas like tuned whips or dipoles) High rejection of the strong wideband signals like high voltage lines spurious, indirect effects of lightening, etc... 2 tuned loops are highly isolated (particularly when they are perpendicular with one frame in the central axis of the other one).	Compared to the whip antennas: Better listening comfort, reduced Bit Error Rate (BER) of data transmissions or FH synchronisation signals. Extra filters can be avoided in many applications. Operational in industrial zones and areas of frequent lightning. Simultaneous transmission and reception on the same narrow site (head of a star chained network, duplex station, HF-HF relay,...)
Fully capacitive tuning unit, without coil nor magnetic signature effect	Interesting for certain ships

HF/125W fast tuned frame antennas can find a number of applications for point to point, ground to air and ship to shore applications at any distance to 1000 km.

OLD MILITARY HF - ANTENNAS OF COMMUNICATION CARS

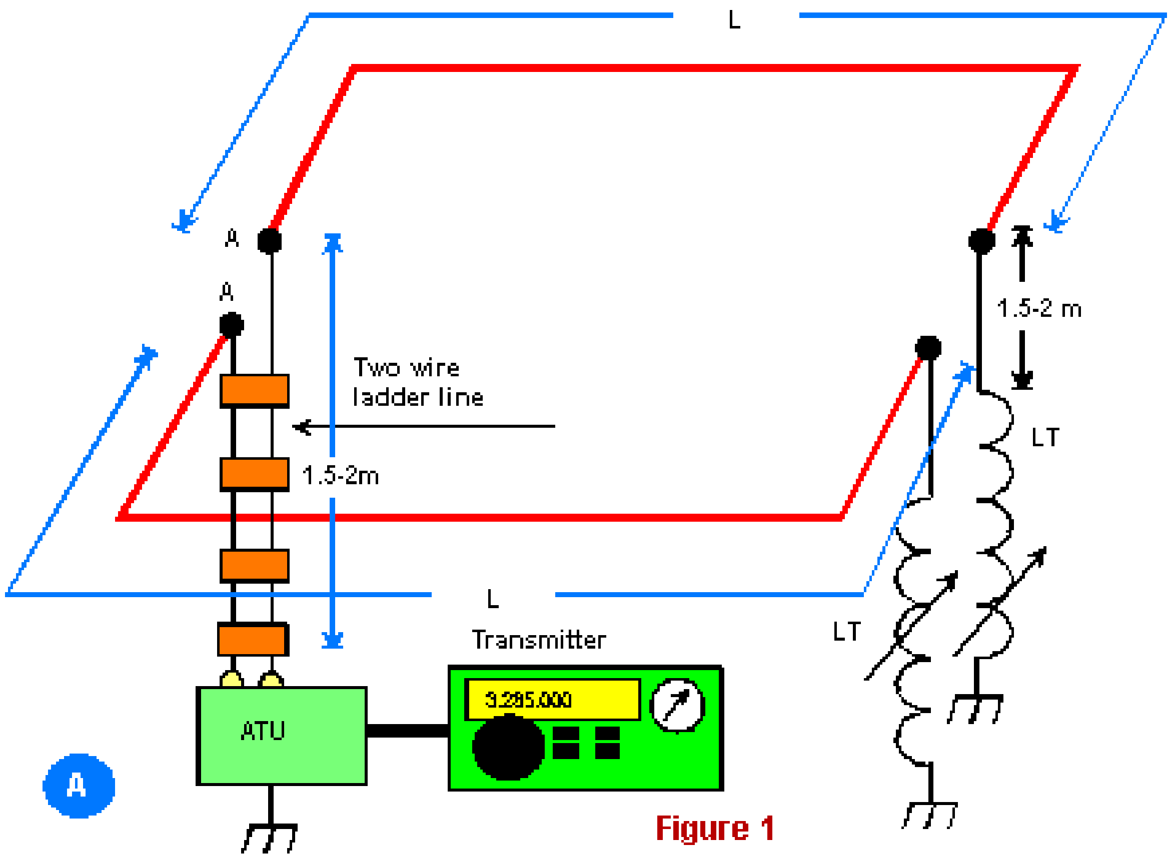
Igor Grigorov, RK3ZK
antentop@mail.ru

I have a small collection of information about old military HF antennas used over the World. Presently, three old military automobile HF antennas are described at the article. The antennas are written "as it is," i.e., I give all information, that I have had. I know, the information is not complete at all, but, nevertheless, the information is interesting and it can help somebody to make own 'car antennas.'

Tuned dipole

Tuned dipole exhibited in **Figure 1** was used in army of the USSR. Scheme for the antenna is shown in **Figure 1a**. Tuned dipole made from a strong tube that has diameter 15 to 30 mm. The tube is installed at height of 1-1,5 m above the roof of an automobile and goes out approximately on 1 meter for overall dimensions of the automobile, as it is exhibited in **Figure 1b**. Tuned dipole has high radiation both at low and high (mostly) angles. It allows the antenna to make links by earth and reflected from ionosphere wave.

Figure 1 Tuned dipole



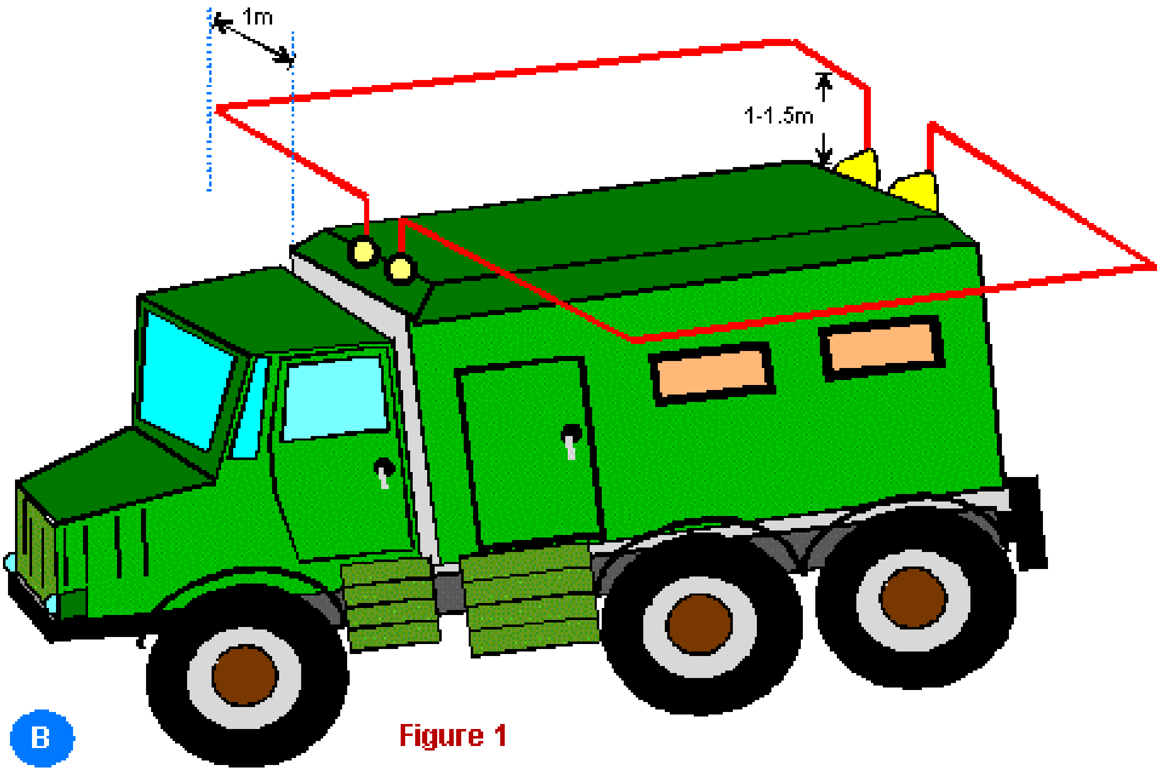


Figure 1

Length 'L' of the antenna (see **Figure 1a**) depends to dimensions of a car, where the antenna is installed, usually the length close to 6 meters. The antenna feeds with help a short length of a two-wire line, usually the length is equal to 2- 3 meters, an ATU is used. Antenna is adjusted with help of a symmetrical variometer 'LT' installed at opposite ends of the tuned dipole. The antenna is tuned on maxima of RF current to points 'A'. In such case the antenna ensures maximum effective work. But in the manual of the antenna is pointed, that the antenna in some cases can be tuned on maxima of RF voltage on points 'A'. Such set-up for the antenna is possible if the communication car is placed on a good conducting surface (it can be moist salty soil) or by operation from natural shelters - holes, ravine. Inductances of antenna variometer vary from several microhenry up to 300 microhenrie. The antenna works good at 2-25 MHz.

At usage of this antenna in military communication car, the antenna gives that advantage, that the roof of the automobile remains free. It enables to install on the roof other antennas, for example, for VHF-UHF ranges

Folded dipole

Folded dipole was in use within the World War – II and till 70s of the 20 century. The dipole is a wire folded by meander and loaded to serial coil plus a capacitor. **Figure 2** shows the disposition of the folded dipole on communication car. The antenna is located at the altitude approximately at 1-1,5 meters above the roof. **Figure 3** shows the scheme of the antenna. Wings of the folded dipole could reach to 10-15 meters in length. It depends on sizes of the car.

Folded dipole is fed by two-wire ladder line in length about 3 meters. The line is connected to an ATU. The antenna is tuned on maxima of RF current to points 'A'. Folded dipole is tuned in resonance in the operation frequencies with help of loading spools 'LT' together with capacitor 'C', that made as a constructing part of the car.

The antenna is intended for 60-90 meters, and usually does not work at other ranges. . Folded dipole has strongly radiation to the sky and a little to the horizon.

Dipole with low characteristic impedance

Dipole with low characteristic impedance is intended for a work at wide frequencies range and for installation on the roof of a communication car that has small dimensions. **Figure 4** shows the scheme (**Figure 4A**) and disposition (**Figure 4B**) of the dipole on communication car. I must say, that I have seen some photos, where the antenna was installed athwart to the roof, as it is shown at **Figure 4C.** The antenna is located at the altitude approximately at 1 meter above the roof. Wings of the dipole made as a metal grid has shape, crosswire at the cells soldered. The wing of the dipole has the width in (0,5-1,5)-meters and the length (1,5-2)-meters.

Figure 5 shows the scheme of feeding of dipole with low characteristic impedance. The antenna is connected through a two-wire ladder line in about 2 meters length to an ATU. The ATU has a resonance

Figure 2 *Folded dipole placed on communication car*

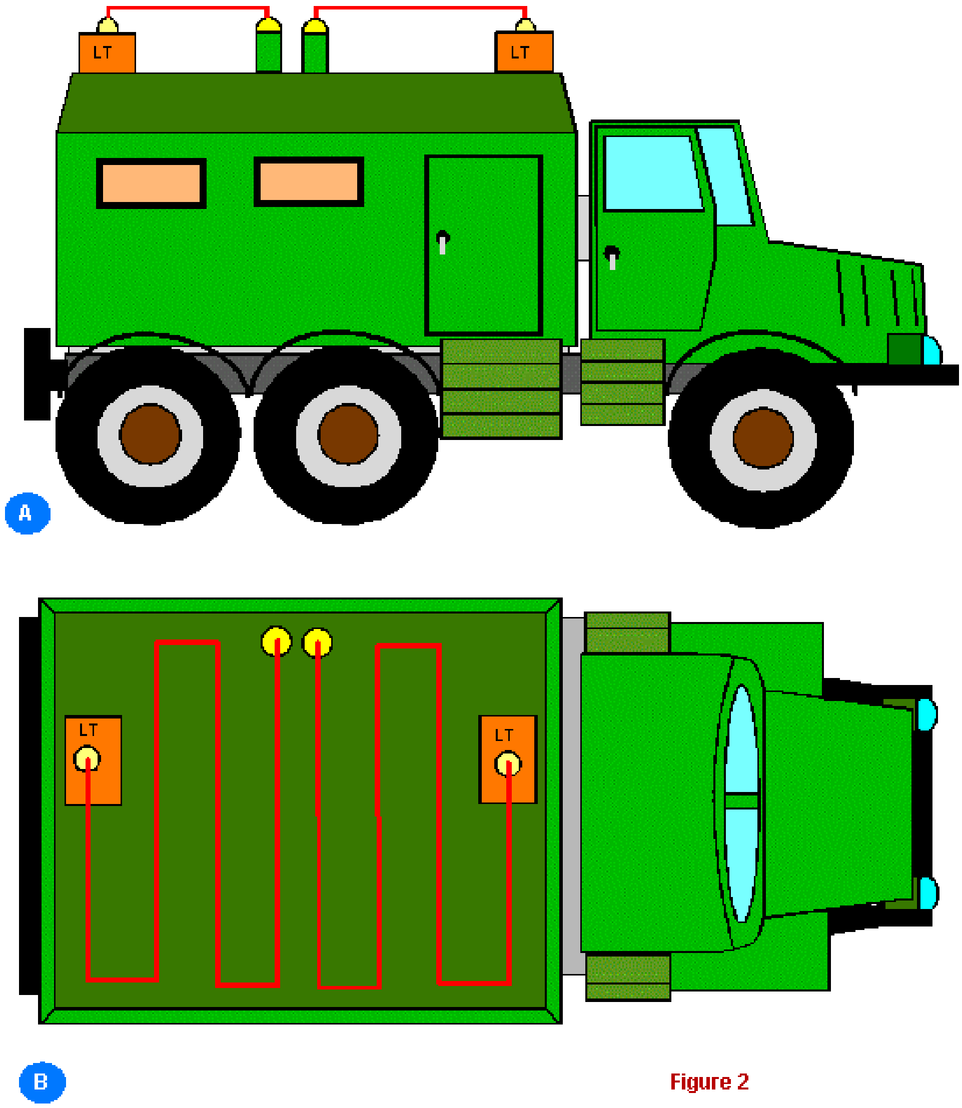


Figure 3 *Scheme of the folded dipole*

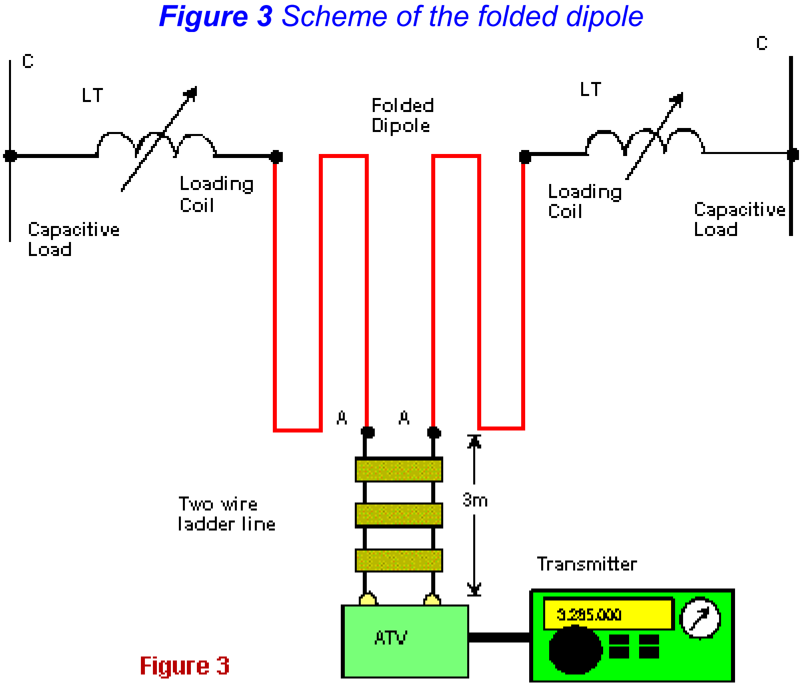


Figure 4 *Dipole with low characteristic impedance*

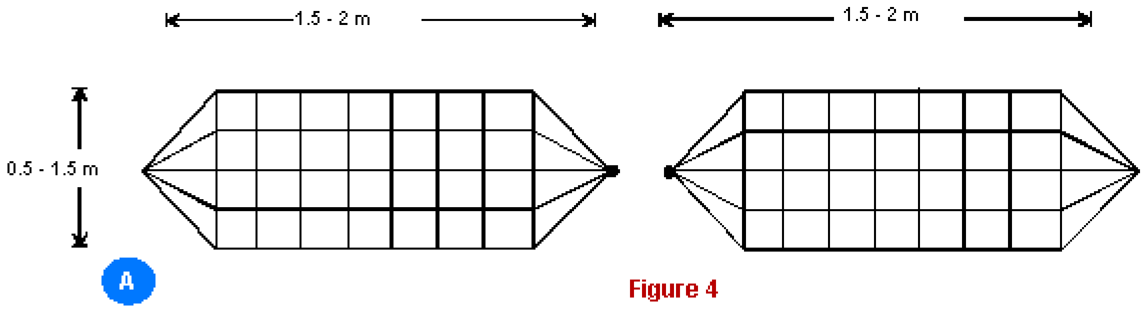


Figure 4

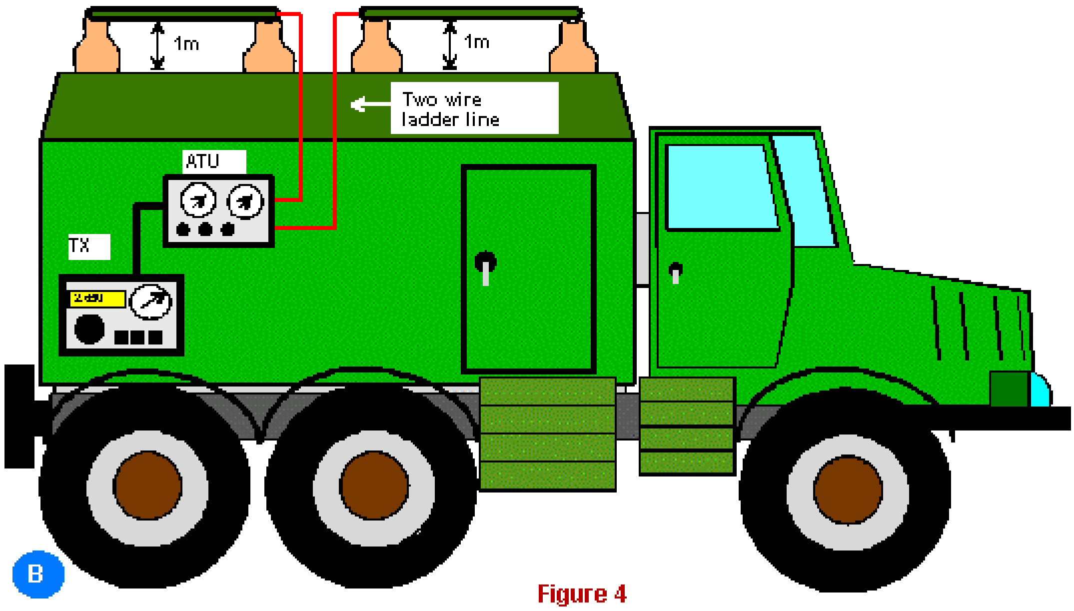


Figure 4

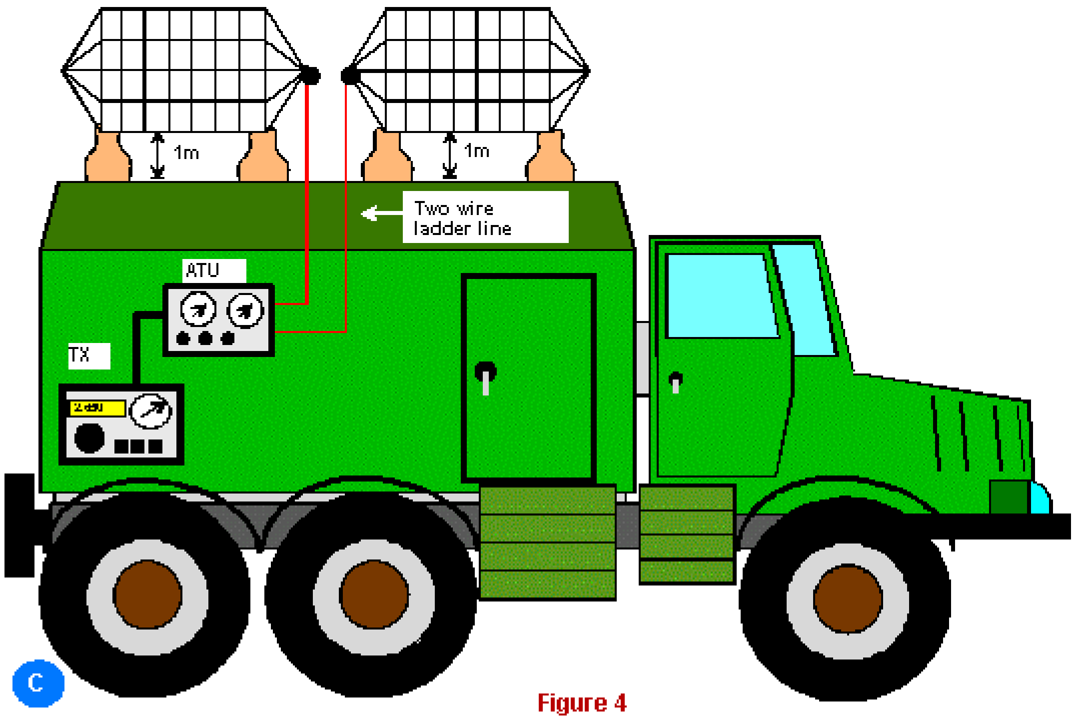


Figure 4

Figure 5 *Scheme of feeding of dipole with low characteristic impedance.*

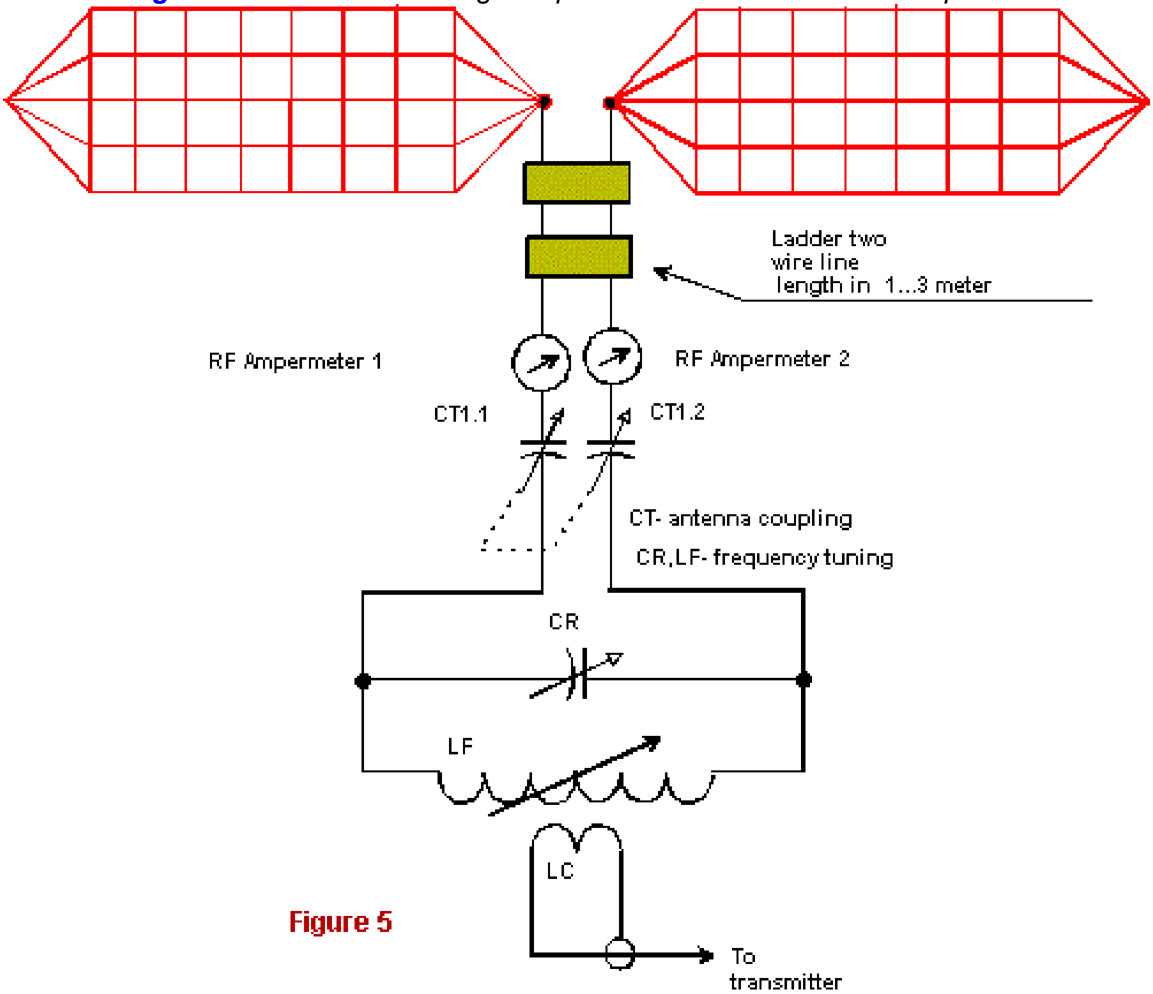


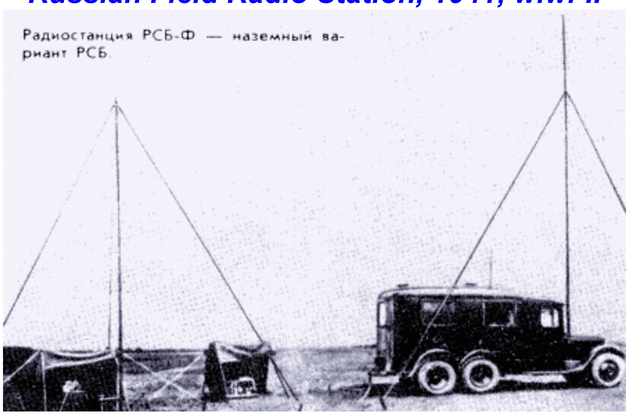
Figure 5

circuit 'LF- CR', that is coupled with help of coupling coil 'LC' with a transmitter. With the help of variable spool 'LF' and variable capacitor 'CR' this circuit can be retune in the frequencies range of 2-20 MHz. In the same frequency range the antenna works. Maxima of RF current in to the antenna is installed with the help of variable symmetrical capacitor 'CT.'

Such antenna was widely used in communication cars during the World War-II and some time after the war. The antenna ensures the sure communication with zenith radiation in HF range 2- 4 MHz in radius of 200-300 km from the antenna. Also this antenna ensures long-distance communication in HF ranges 5-20 MHz.

But this antenna had the deficiencies: at the first, it has too complicated matching device, at the second the antenna takes too much place in the roof of the car. For these reasons, since of the end of 50s, the antenna practically is not used in military communication cars.

Russian Field Radio Station, 1941, w.w.-II



Russian Field Radio Station, 1913, w.w.-I

MODERN MILITARY HF - ANTENNAS OF COMMUNICATION CARS

Igor Grigorov, RK3ZK
antentop@mail.ru

I have a small collection of information about old and modern military HF antennas used over the World. Presently, two modern automobile HF antennas are described at the article. The antennas are written "as it is," i.e., I give all information, that I have had. I know, the information is not complete at all, but, nevertheless, the information is interesting and it can help somebody to make own 'car antennas.'

The basic types of military *antennas, which for a long time were used on communication cars, were construed during and before the World War II. After WW-II researches for new antennas for communication cars was renewed. Below we shall consider two new type of car antennas which have appeared in army after the World War-II still are in use on modern communication car. There are magnet antennas and DDRR antennas, that began to be used for communication cars (under my information) rather recently - in the middle of 70s years of the 20 century.*

Mag Loop antennas of communication cars *for 150-80 meters*

As usual a magnet antenna of the range is installed on a communication car as it is shown in **Figure 1**. The magnet antenna ensures sure communication in radius of 200 kms at the daylight time and up to 400 kilometers at the night time.

Figure 1 Magnet antenna on a communication car

The magnet antenna at marching condition is installed parallel to the car roof (see. **Figure 1a**) and does not hinder to ride the car under low bridges or under trees in forests. The magnet antenna stands in operating position with the help of an electric motor or by operator hand. **Figure 1b** shows the zenith magnet antenna in the operating position.

The magnet antenna (item 2, **Figure 1b**) is tuned in resonance on the operating frequency with the help of variable capacitor (item 3, **Figure 1b**), which is weatherproofed by hermetic box (item 4, **Figure 1b**). The variable capacitor is turned with the help of an electric motor. The magnet antenna is drove by a small loop (item 1, **Figure 1b**) that is installed in corner of the magnet antenna. Driven loop is coupled to the transmitter with the help of a coaxial cable by characteristic impedance of100 Ohm. The sizes of the army magnet antenna for operation in 150 - 80 meters are exhibited in **Figure 1b**.

Mag Loop antennas of *communication cars* for meters

Also magnet antennas are used for operation in HF ra 60 meters. Such magnet antenna has smaller contrasted to magnet antenna intended for operation meters. Magnet antenna for 90-60 meters owing to sizes is installed or above the roof of the cabin of comn car (see **Figure 2**) or at back edge of the car (see **Figure 3**). At this installation of mag loop the roof of the car is free to place other antennas or some more electronic equipment. The sizes of the magnet antenna for operation in 90 - 60 meters are exhibited in **Figure 2** and **Figure 3.**

Figure 2 Magnet antenna above the roof of the car cabin

Figure 3 Magnet antenna on the back edge of the car

The magnet antennas shown in **Figures 1-3** usually are made of an aluminum bent tube in 20- 40 millimeters in OD and 2-3 millimeters thick.

Magnet antennas for 150 -90 meters is not intended for operation when a communication car is moving. But Magnet antennas for 90 - 60 meters can be used when a communication car is moving.

Magnet antenna on a communication car

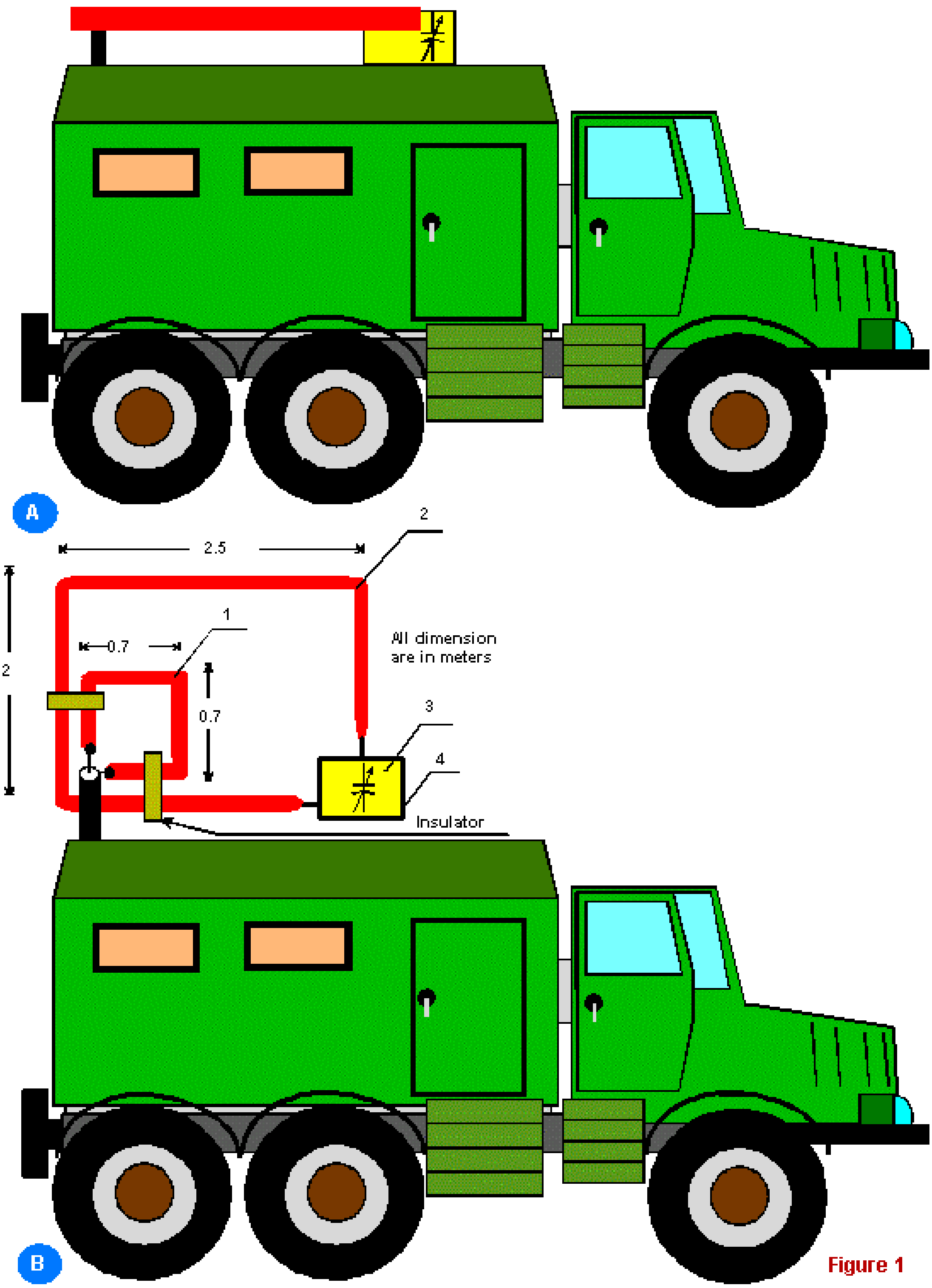


Figure 1

Antennas DDRR in military communication

Antennas DDRR are used in military communication of many countries. **Figure 4** shows the schematic of antenna DDRR. Say simple the antenna represents a tube bent in shape of letter "L". The length of the 'L'

Is little smaller the quarter wave of the high lower range of the antenna, but the length 'L' not less the lower operation range of the antenna. Antenna DDRI to resonance by the variable capacitor C which is dri electric motor M. Antenna DDRR, as usual, is mad aluminum tube in 20-40 millimeters OD.

Figure 4 Schematic of Antenna DDRR of communicati

Magnet antenna above the roof of the car cabin

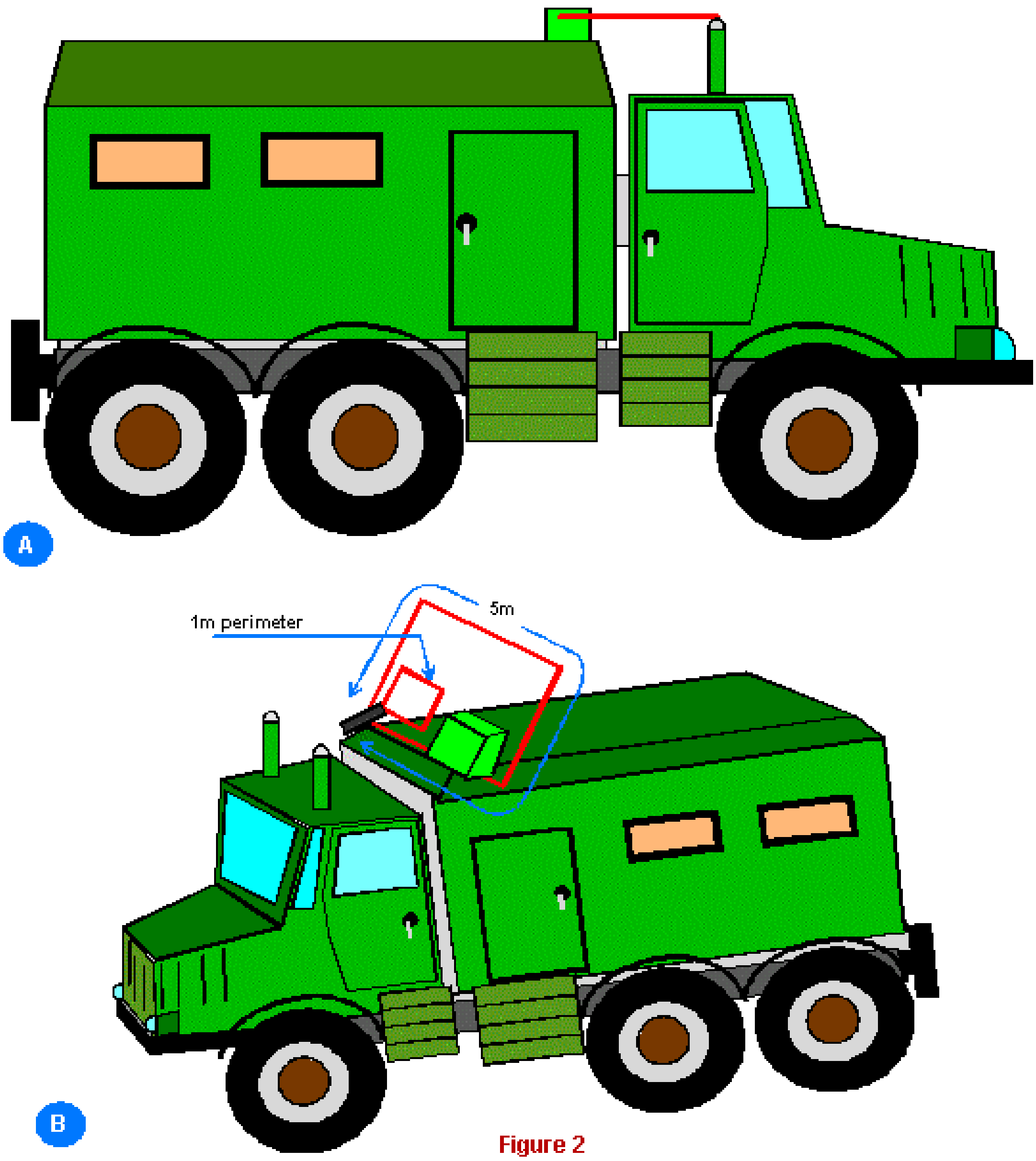


Figure 2

On military vehicles an antenna DDRR usually places on one of edges as it is shown in **Figure 5**. It allows to install other antennas on the roof of the communication car. Antennas DDRR often serve as enclosure of the roof.

Figure 5 Antenna DDRR on military vehicle

Antennas DDRR also are used on some heavy tanks or BMI (battle machine of infantry). On this military vehicle the antenna DDRR serves as a rail for other hand. Antenna DDRR has mechanically strong design, so it is difficult to damage an antenna DDRR in battle.

Seldom use two antennas DDRR that fed with some phase shift to create special diagram directivity. **Figure 6** shows such antenna array.

Figure 6 Array of antennas DDRR

Antenna DDRR is very strong and allows to do comr when the car is moving. Radio amateurs also can us DDRR for the operation in ether at installation on the rc car.

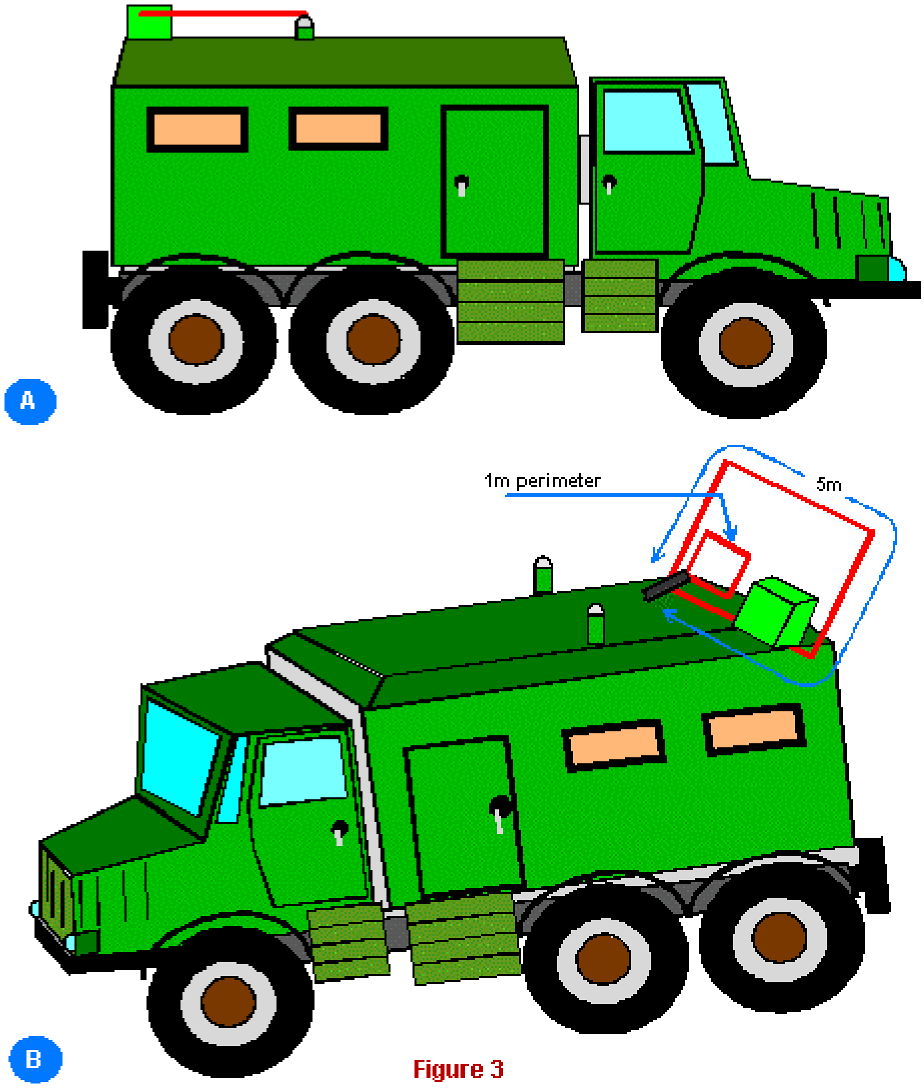


Figure 3

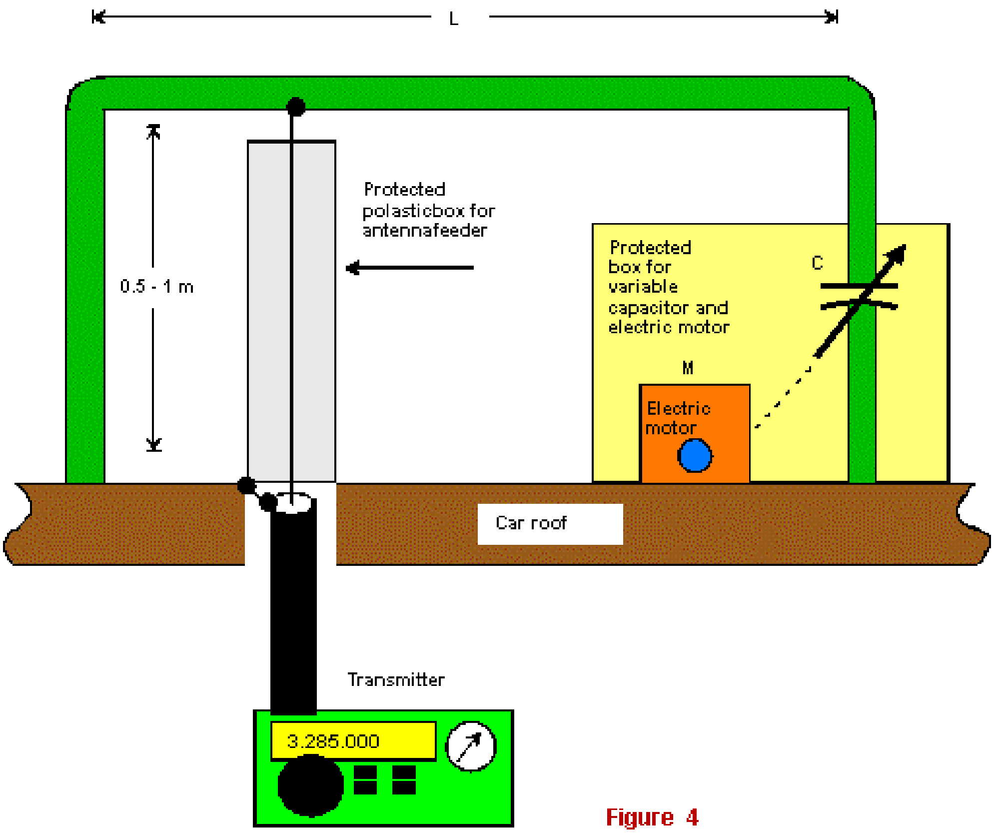


Figure 4

Antenna DDRR on military vehicle

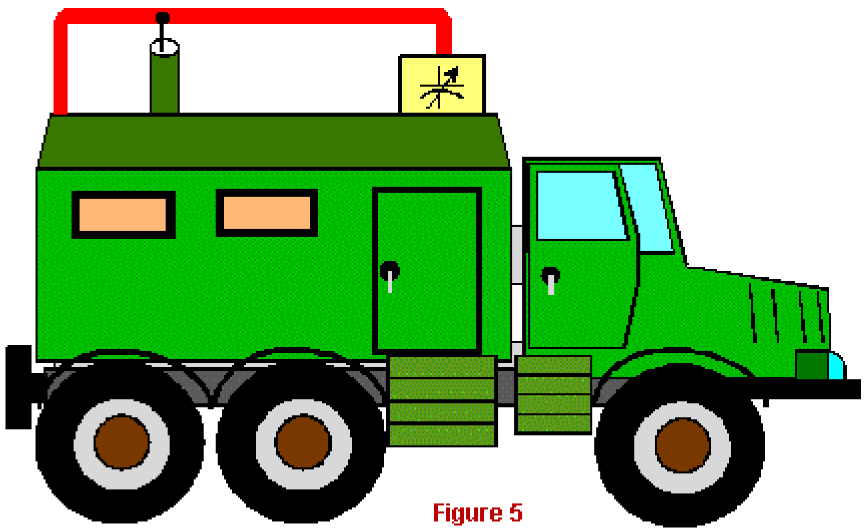


Figure 5

Array of antennas DDRR

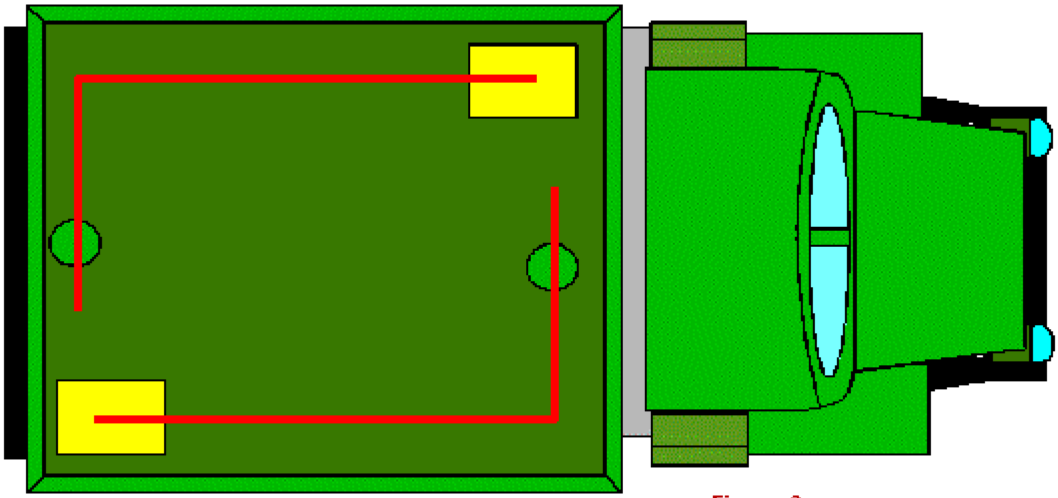


Figure 6

FIELD UNIVERSAL HF ANTENNA RV3DA

Igor Grigor'ev, RV3DA

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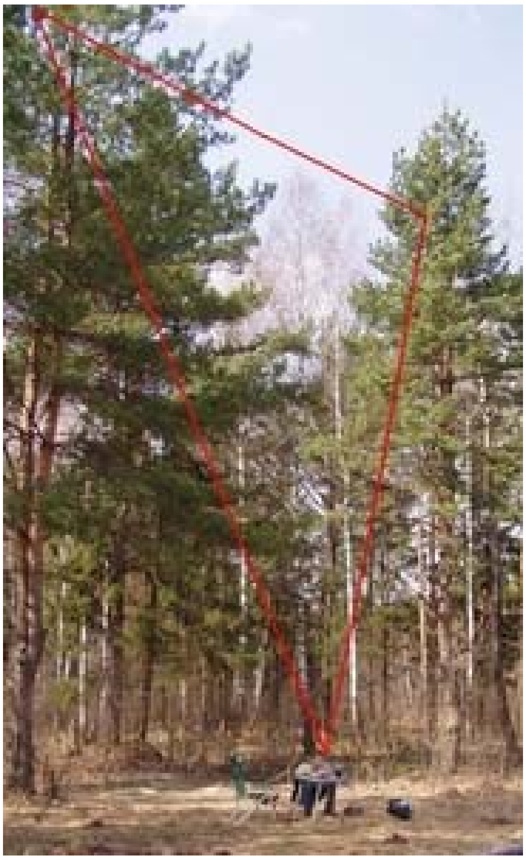
http: // www.qsl.net/rk3dzd

In Russia summer traditionally is the season for radio expeditions. So, the question about a field antenna stands before hundreds radio amateurs. Certainly, it is impossible to give one answer to this question. A design of an antenna for fields depends on many factors. There are frequencies bands used by radio expedition, local factors for antenna installation, time and money and so on. Igor, RV3DA, has developed universal wire antenna. This one with ATU works well on all amateurs short-wave ranges, including WARC. factors. There are frequencies bands used by radio expedition, local factors for antenna installation, time and money and so on. Igor, RV3DA, has developed universal wire antenna. This one with ATU works well on all amateurs short-wave ranges, including WARC.



The antenna has a triangular shape, one of the ends of the triangular is grounded. **Figure 1** shows the circuit of the antenna. A good grounding is necessary for successful work of the antenna. However, the antenna provides good work without good grounding also.

The antenna was tested by team of collective radio station RK3DZD in field conditions.

On Eastern Sunday April 11 we have been going to RDA- pedition. About RDA program you can see ***page 86, ANTENTOP# 2- 2004***. Our team (RD3DT, UA3DUS, RZ3DT and RV3DA) and buys settled down at picturesque surroundings of the edge of Tsna river, Egor'evskoe area **MO-62** at Moscow oblast.

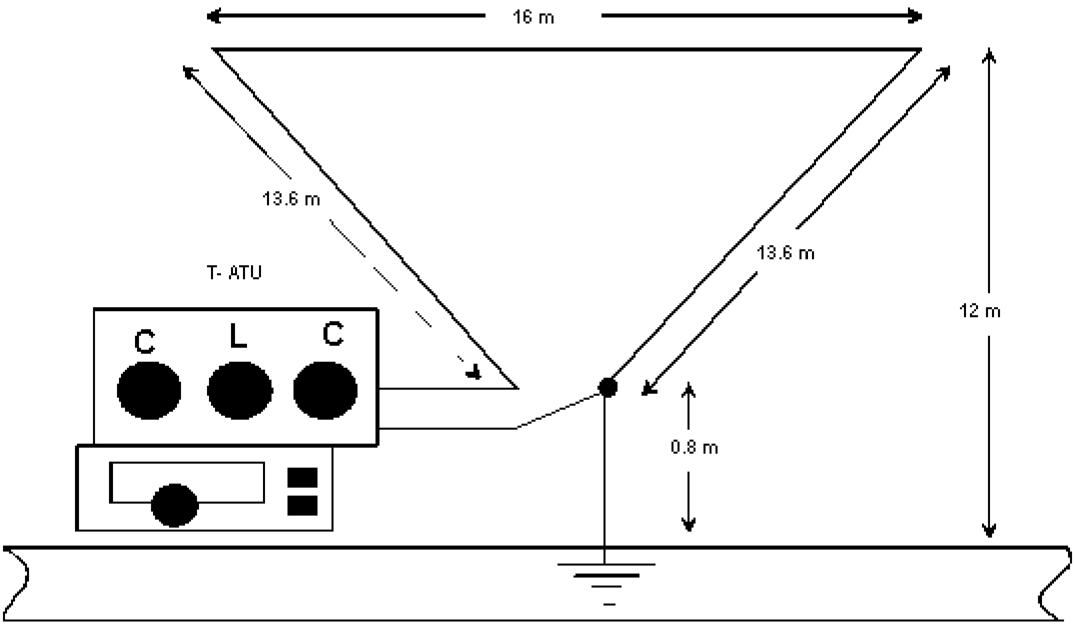


Figure 1

Yuri, RA3DUF, hanged our antenna on the nearest pines. TNX to Yuri, RK3DUF for steeplejack works! You can see a photo of the antenna (antenna colored by red). The antenna had no feeder and was connected directly to a transceiver FT-847 through a home- made T- ATU that was placed at the table. We used an automobile accumulator 55-A/h and gas-generator Honda for feeding our equipment.

Grounding was very bad - a pipe in diameter of ½" and in length of 1 meter. The ground was very damp, ten meters father from the antenna a river was. The antenna was hanged between two high pines.

What we have had:

1. 40 meters - is higher than any praises. Really, we ruled by pile- up from tens calling stations. Simultaneously we received as local as DX- stations.

2. 20 meters – the directivity of the antenna did bad effect for us. The antenna was directed to the North - South, that it was not good for us. Southern radio stations simply rattled in the Air!

3. 15 meters- Japanese called us very loudly.

4. On 10 meters was dead (no propagation).

5. 80 meters – we received very loudly many radio station from Siberia (2000- 3000 kms from us) but our sign was received poor in Siberia because, as we think, of poor grounding.

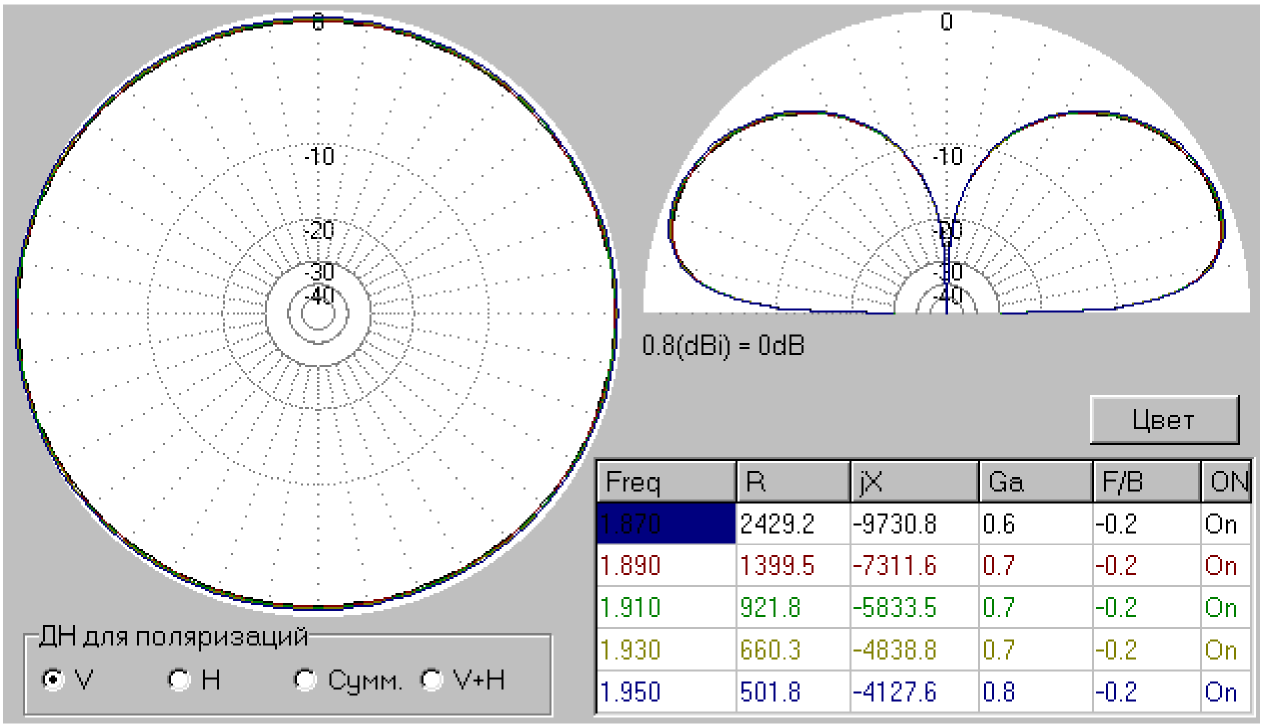
Below given diagram directivity for the antenna obtained with help of free antenna program MMANA (MININEC based). Left diagram is a section of the volumetric diagram directivity of plane X-Y at a zenith corner of the maximum radiation. The right diagram is section of the volumetric diagram directivity of plane X-Z. Also at the right down corner of the pictures is a table with antenna impedance. Please, take attention to the data, you can do decision how you ATU does match of the

73!
Igor Grigor'ev, RV3DA

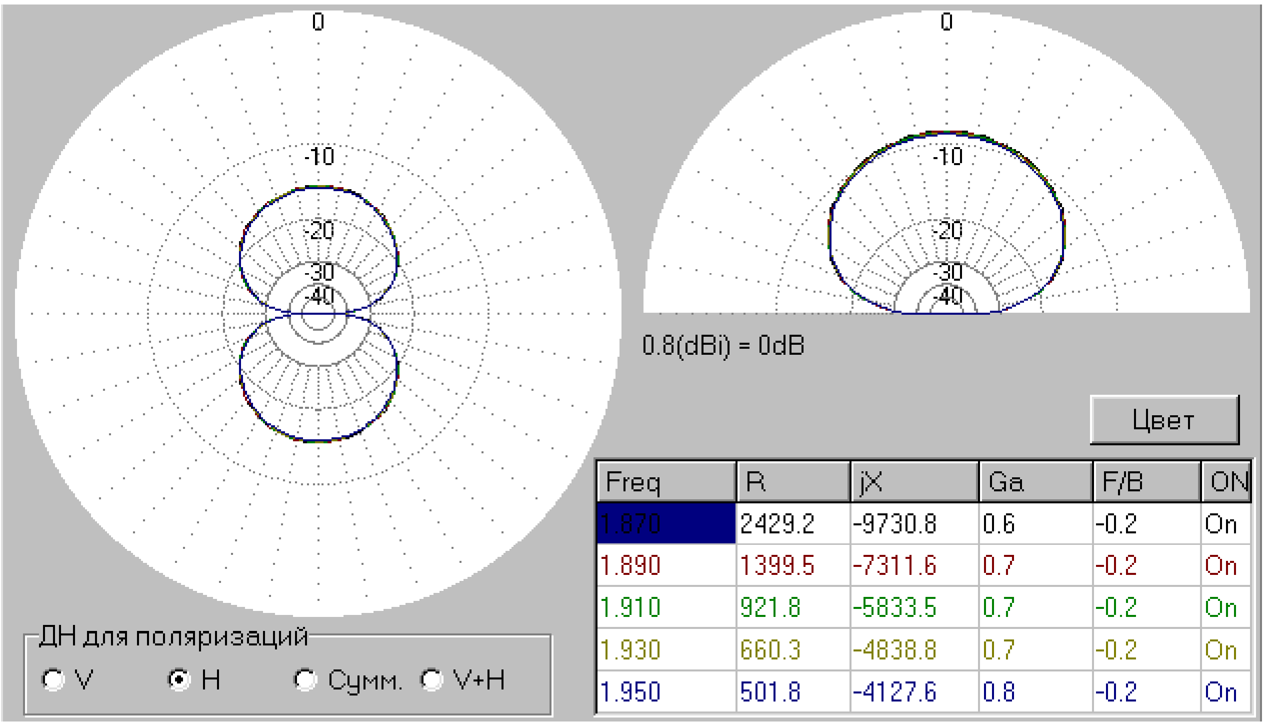
So our first workplace looked. As usual, we had too little time for preparing before our pedition, so, we have used "table" T-ATU. Two air variable capacitors and a variable inductor placed on the table without any case. Yury, RK3DUF, did DX- QSO.

Antenna RV3DA at 160-m

Vertical Radiation Pattern



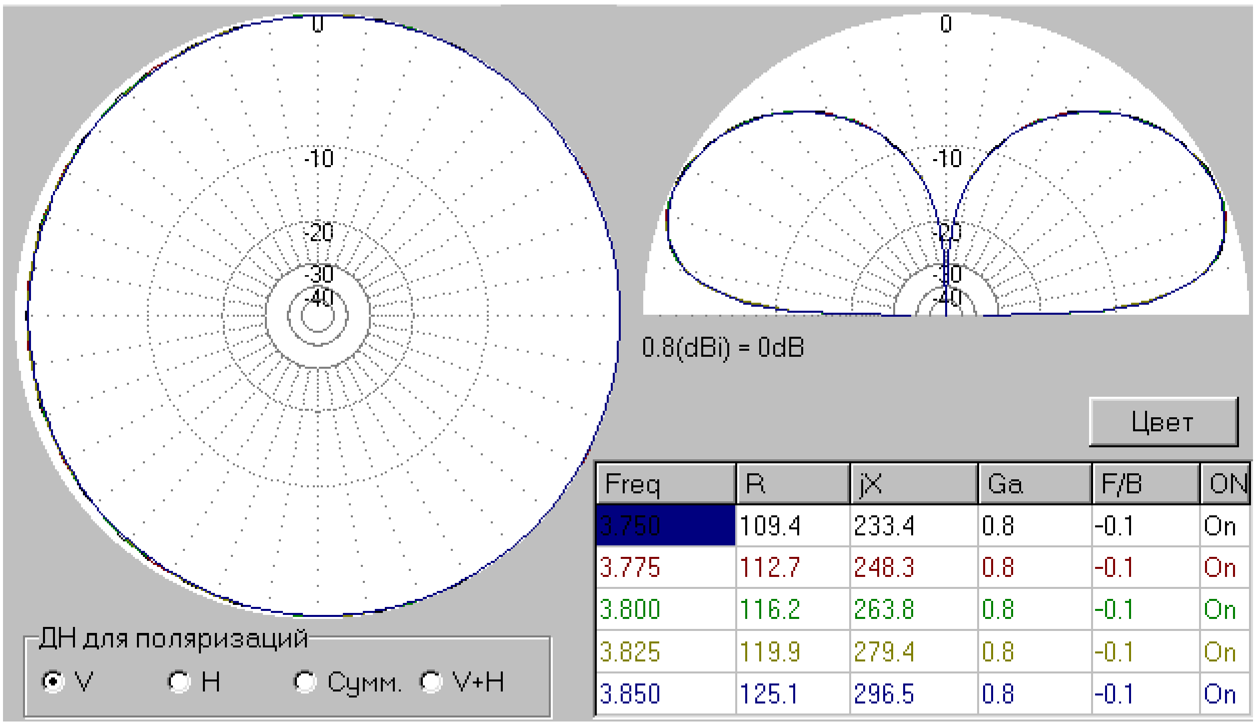
Horizon Radiation Pattern



Comments: Antenna radiates mainly radio waves with vertical polarization. A very good pattern with low lobes in the vertical plane. Circular pattern in horizontal plane. It is fine for DX- QSO. But antenna has Z= 921-j5833-Ohms at 1910-kHz. Not all ATUs do good matching for such load.

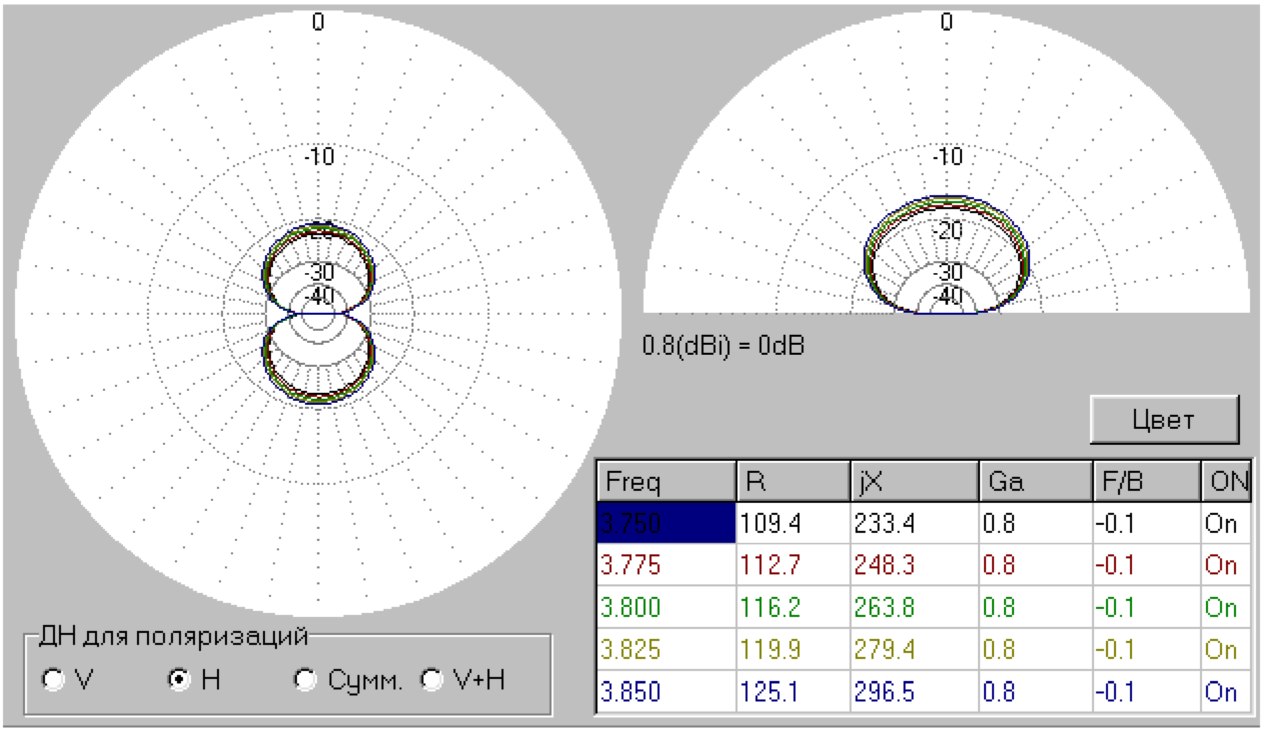
Antenna RV3DA at 80-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
3.750	109.4	233.4	0.8	-0.1	On
3.775	112.7	248.3	0.8	-0.1	On
3.800	116.2	263.8	0.8	-0.1	On
3.825	119.9	279.4	0.8	-0.1	On
3.850	125.1	296.5	0.8	-0.1	On

Horizon Radiation Pattern

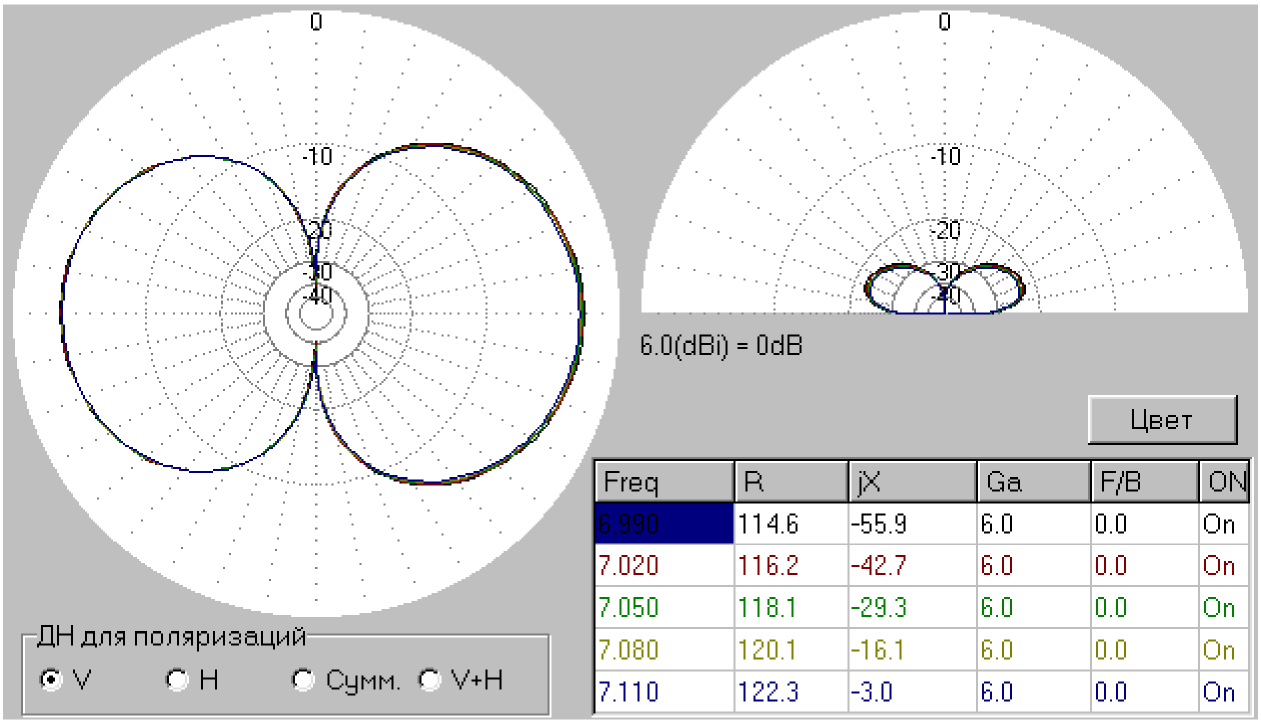


Freq	R	jX	Ga	F/B	ON
3.750	109.4	233.4	0.8	-0.1	On
3.775	112.7	248.3	0.8	-0.1	On
3.800	116.2	263.8	0.8	-0.1	On
3.825	119.9	279.4	0.8	-0.1	On
3.850	125.1	296.5	0.8	-0.1	On

Comments: Antenna radiates mainly radio waves with vertical polarization. A very good pattern with low lobes in the vertical plane. Circular pattern in horizontal plane. It is fine for DX- QSO. Antenna has Z= 116+ j263-Ohms at 3800-kHz. Almost any ATU does good matching for such load.

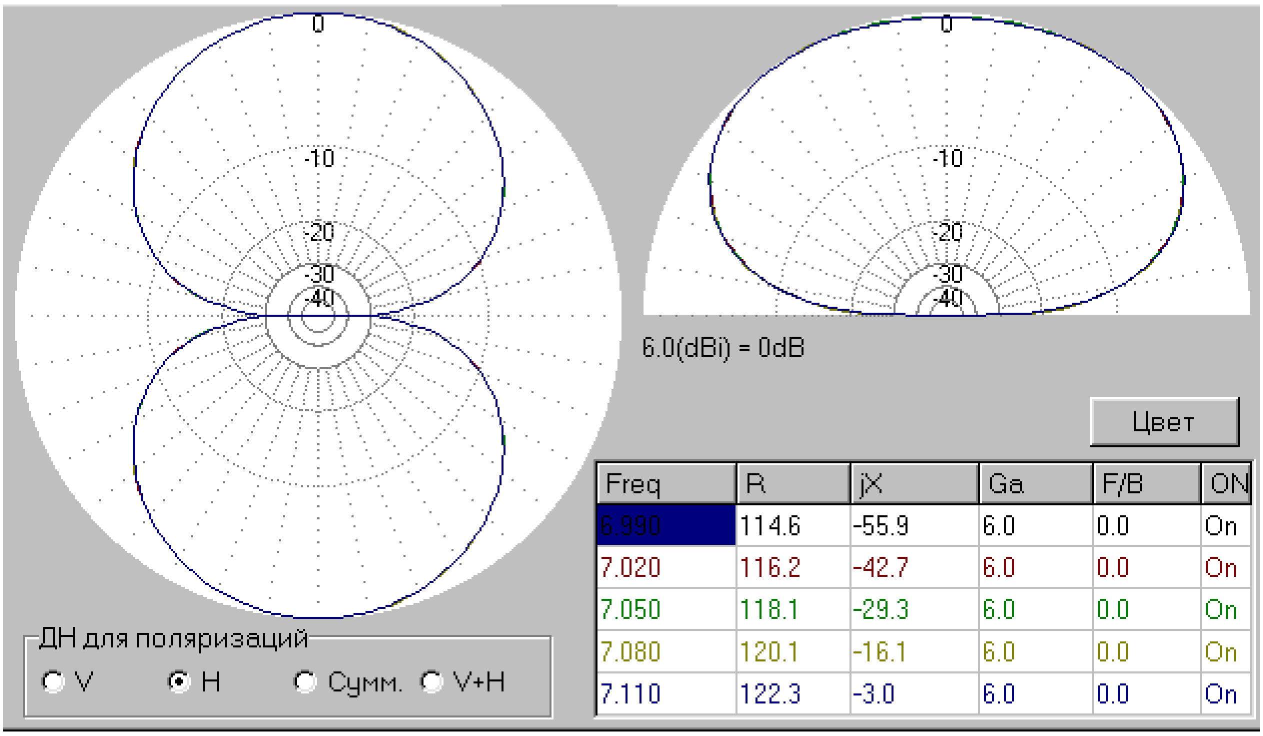
Antenna RV3DA at 40-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
6.990	114.6	-55.9	6.0	0.0	On
7.020	116.2	-42.7	6.0	0.0	On
7.050	118.1	-29.3	6.0	0.0	On
7.080	120.1	-16.1	6.0	0.0	On
7.110	122.3	-3.0	6.0	0.0	On

Horizon Radiation Pattern



Freq	R	jX	Ga	F/B	ON
6.990	114.6	-55.9	6.0	0.0	On
7.020	116.2	-42.7	6.0	0.0	On
7.050	118.1	-29.3	6.0	0.0	On
7.080	120.1	-16.1	6.0	0.0	On
7.110	122.3	-3.0	6.0	0.0	On

Comments: Antenna radiates mainly radio waves with horizontal polarization. A good pattern in the vertical plane. Antenna has strong zenith radiation that allows to do local QSOs. “Eight- figure” pattern in horizontal plane, so, it demands to choose a proper direction before an installation of the antenna. Antenna is fine for DX and local QSOs. Antenna has Z= 116+ j263-Ohms at 3800-kHz. Almost any ATU does good matching for such load.

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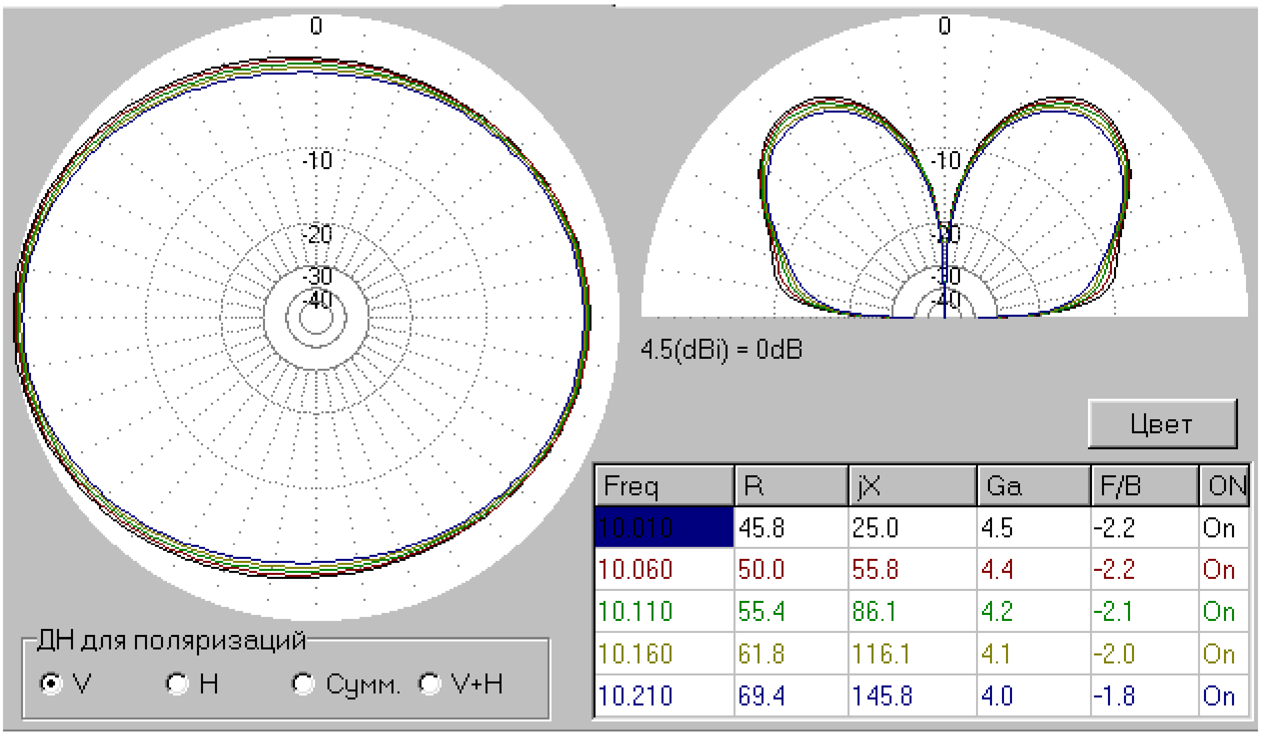
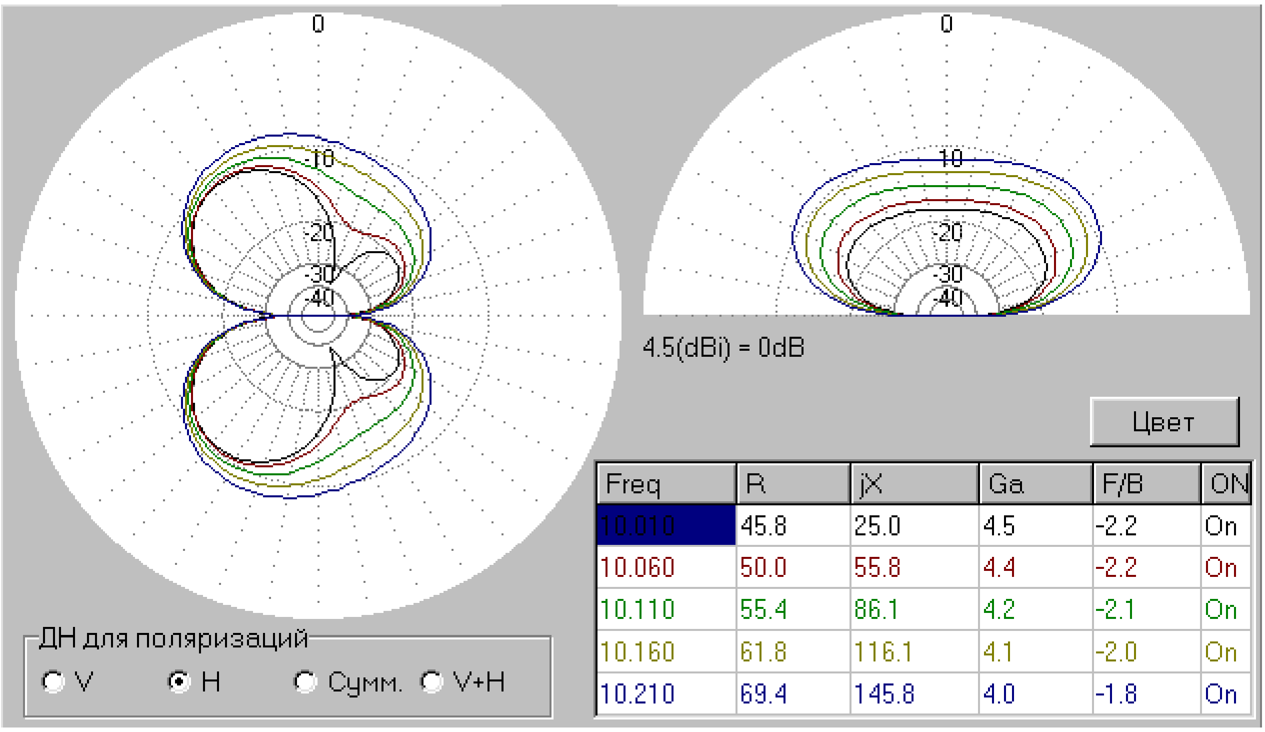
Antenna RV3DA at 30-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
10.010	45.8	25.0	4.5	-2.2	On
10.060	50.0	55.8	4.4	-2.2	On
10.110	55.4	86.1	4.2	-2.1	On
10.160	61.8	116.1	4.1	-2.0	On
10.210	69.4	145.8	4.0	-1.8	On

Horizon Radiation Pattern

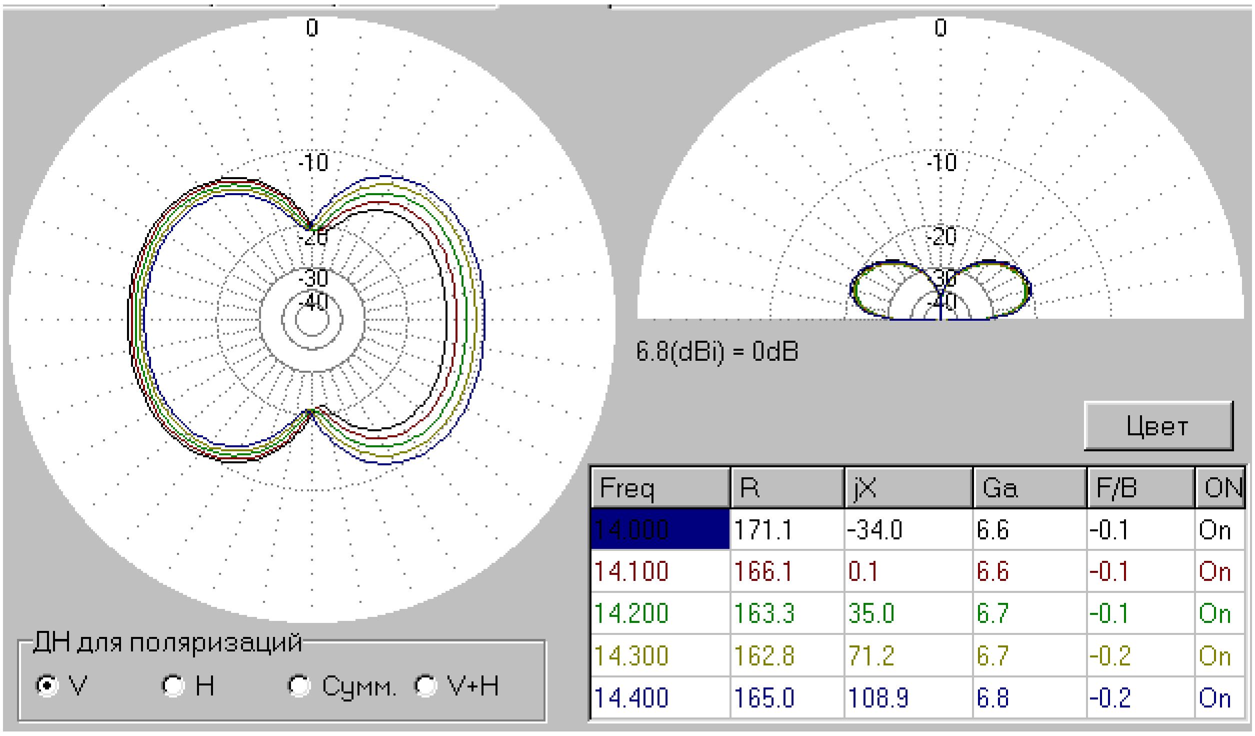


Freq	R	jX	Ga	F/B	ON
10.010	45.8	25.0	4.5	-2.2	On
10.060	50.0	55.8	4.4	-2.2	On
10.110	55.4	86.1	4.2	-2.1	On
10.160	61.8	116.1	4.1	-2.0	On
10.210	69.4	145.8	4.0	-1.8	On

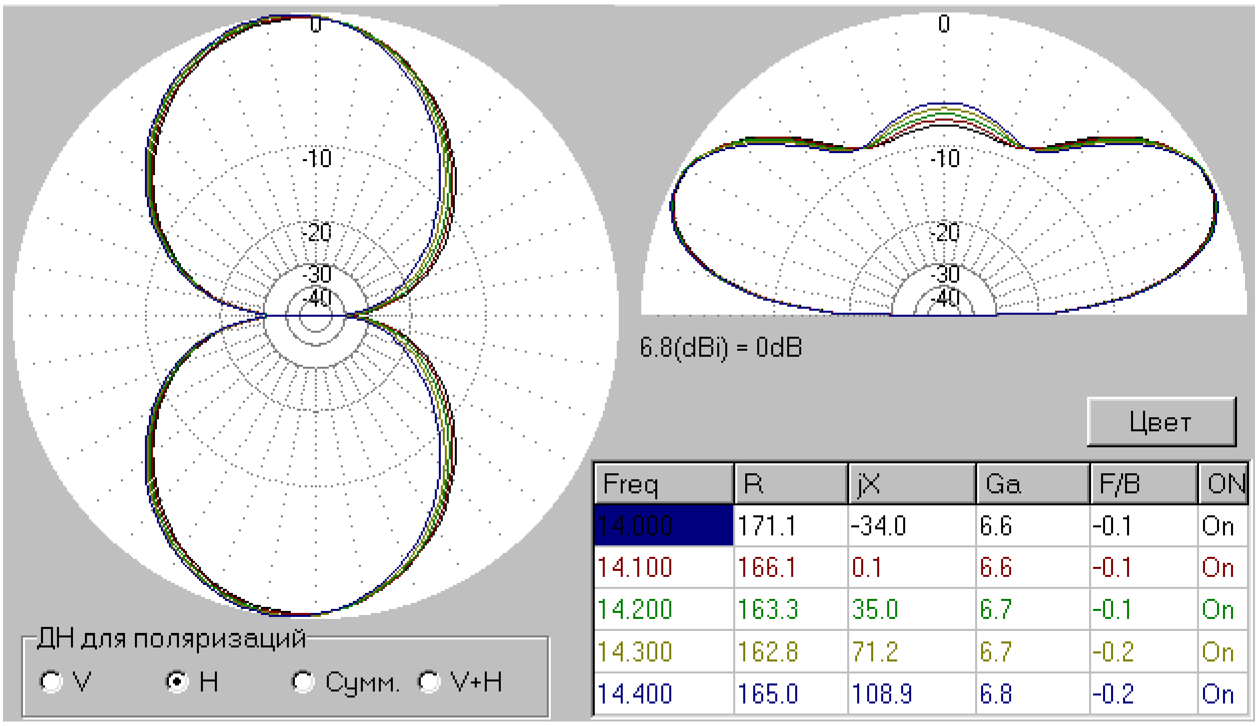
Comments: Antenna has strong vertical radiation. Not bad pattern in the vertical plane. Antenna has strong radiation at high corners that allows to do local QSOs. Antenna has almost circular pattern in horizontal plane. Antenna provides DX and local QSOs. Antenna has Z= 55+ j86-Ohms at 1010-kHz. Any ATU does good matching for such load.

Antenna RV3DA at 20-m

Vertical Radiation Pattern



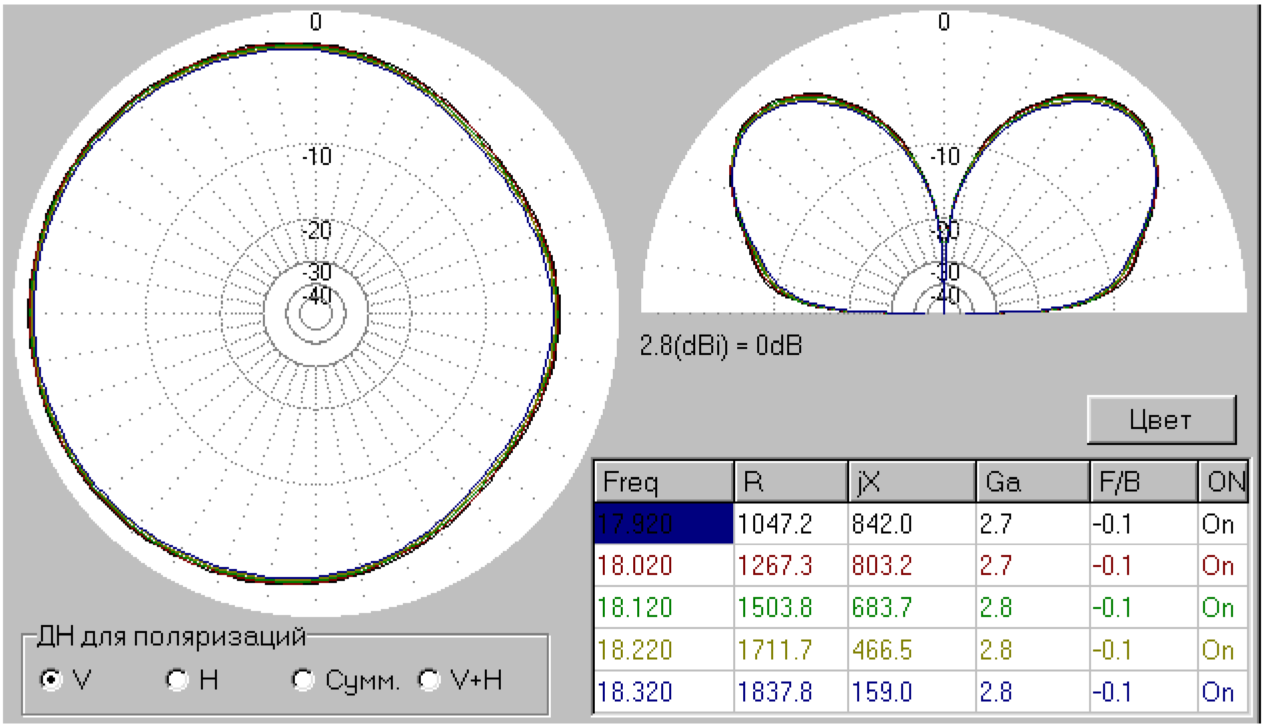
Horizon Radiation Pattern



Comments: Antenna has strong horizon radiation. A good pattern in the vertical plane. Antenna has a strong radiation at low corners that allows to do DX QSOs. Antenna has almost “eight- figure” pattern in horizontal plane, so, it demands to choose a proper direction before an installation of the antenna. Antenna provides DX QSOs. Antenna has the resonance at 14100-kHz at 166 Ohms. Any ATU does good matching for the antenna.

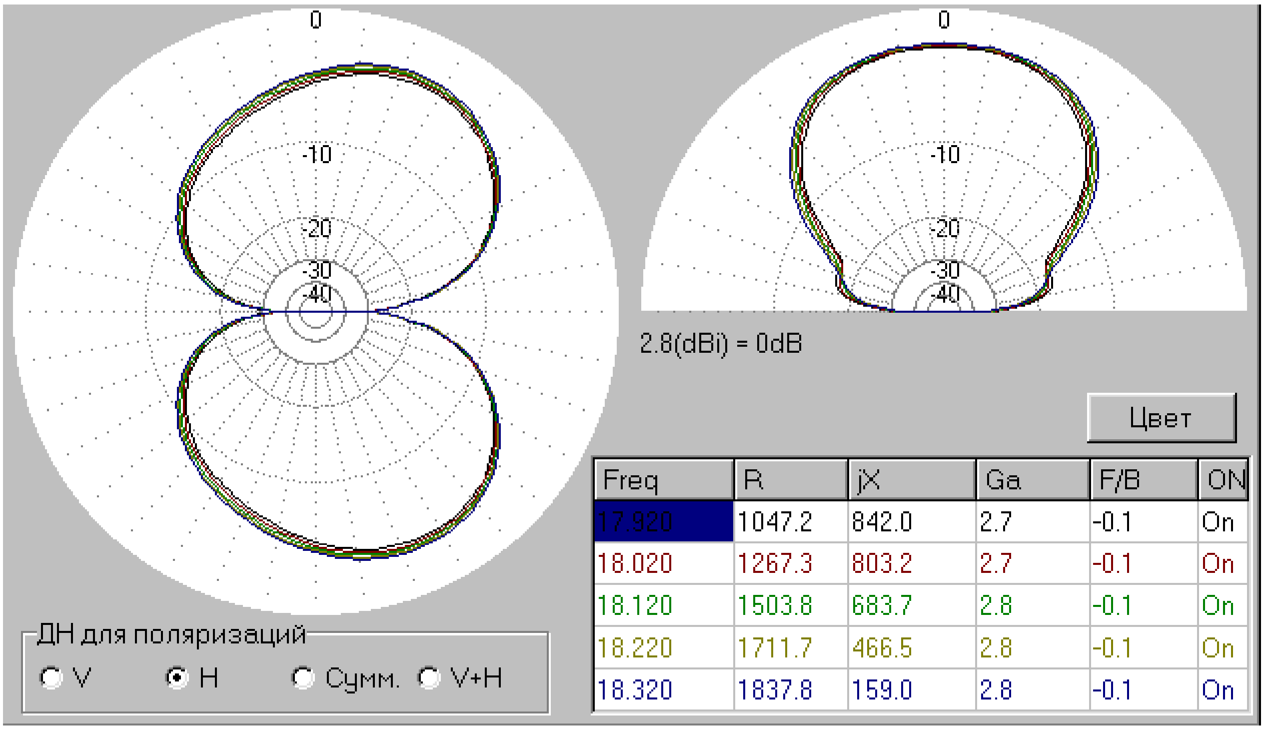
Antenna RV3DA at 17-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
17.920	1047.2	842.0	2.7	-0.1	On
18.020	1267.3	803.2	2.7	-0.1	On
18.120	1503.8	683.7	2.8	-0.1	On
18.220	1711.7	466.5	2.8	-0.1	On
18.320	1837.8	159.0	2.8	-0.1	On

Horizon Radiation Pattern

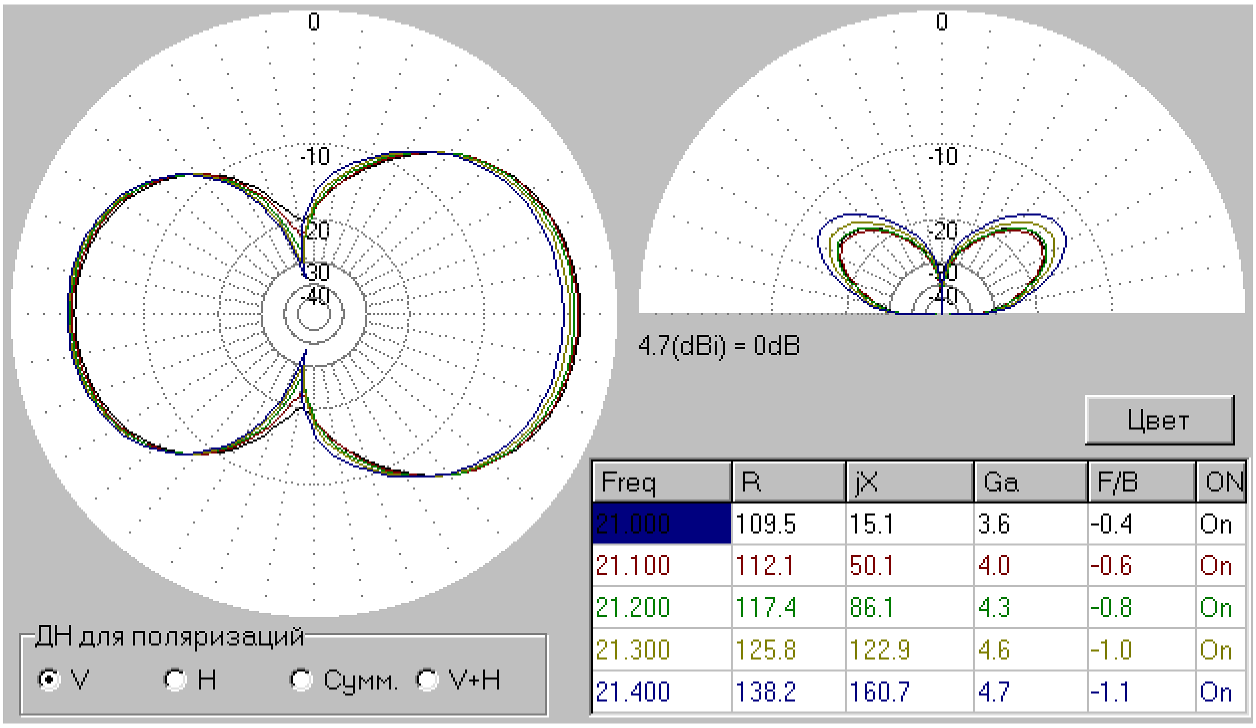


Freq	R	jX	Ga	F/B	ON
17.920	1047.2	842.0	2.7	-0.1	On
18.020	1267.3	803.2	2.7	-0.1	On
18.120	1503.8	683.7	2.8	-0.1	On
18.220	1711.7	466.5	2.8	-0.1	On
18.320	1837.8	159.0	2.8	-0.1	On

Comments: Antenna has both, a strong vertical and strong horizon radiation. For the vertical radiation antenna has a good pattern in the vertical plane, and almost circular pattern in the horizon plane. Pattern for horizon radiation is not so good as to vertical polarization. Antenna can provide DX QSOs at vertical and horizon radiation. Antenna has impedance 1711+j466-Ohms at 18220-kHz. Not all ATUs do good matching for such load.

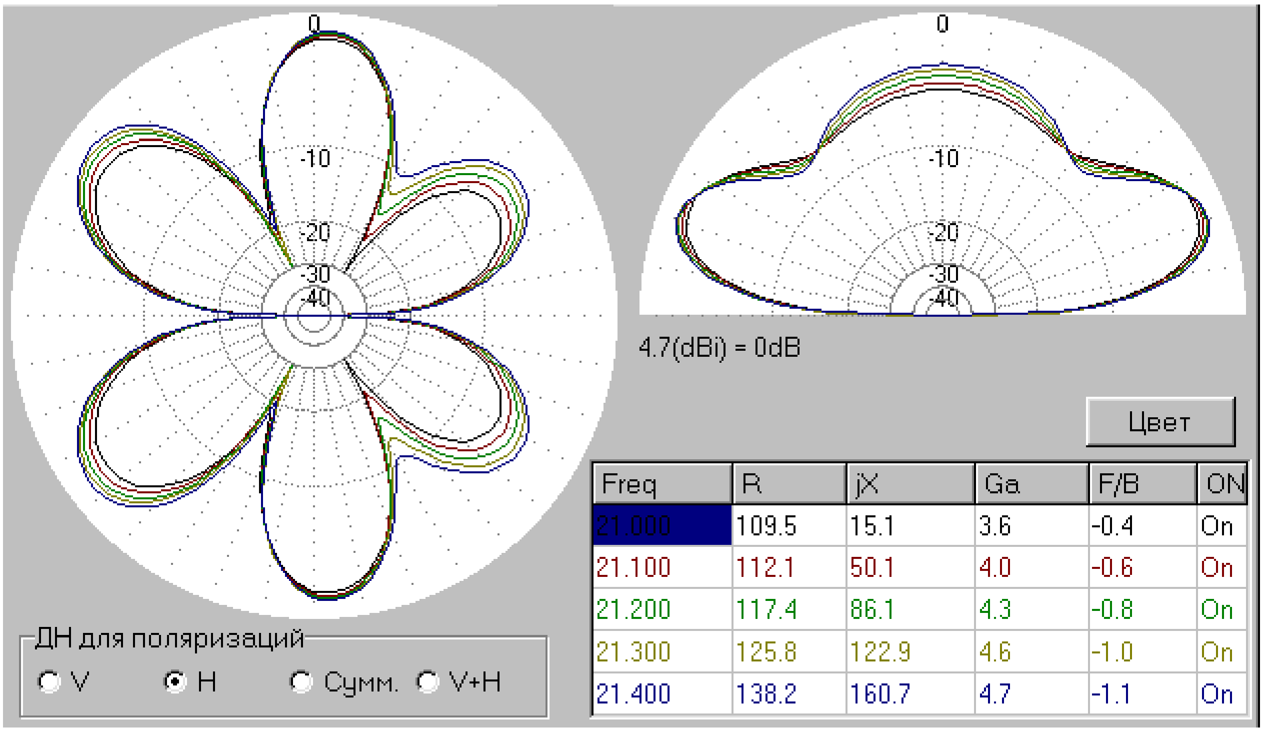
Antenna RV3DA at 15-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
21.000	109.5	15.1	3.6	-0.4	On
21.100	112.1	50.1	4.0	-0.6	On
21.200	117.4	86.1	4.3	-0.8	On
21.300	125.8	122.9	4.6	-1.0	On
21.400	138.2	160.7	4.7	-1.1	On

Horizon Radiation Pattern



Freq	R	jX	Ga	F/B	ON
21.000	109.5	15.1	3.6	-0.4	On
21.100	112.1	50.1	4.0	-0.6	On
21.200	117.4	86.1	4.3	-0.8	On
21.300	125.8	122.9	4.6	-1.0	On
21.400	138.2	160.7	4.7	-1.1	On

Comments: Antenna has both, a strong vertical and strong horizon radiation. For the horizon radiation antenna has a good pattern in the vertical plane with low lobes, and six-lobes pattern in the horizon plane. Pattern for the horizon radiation is not so good as to vertical polarization. Antenna can provide DX QSOs at vertical radiation. Antenna has impedance 117+j86-Ohms at 21200-kHz. Any ATU makes good matching for such load.

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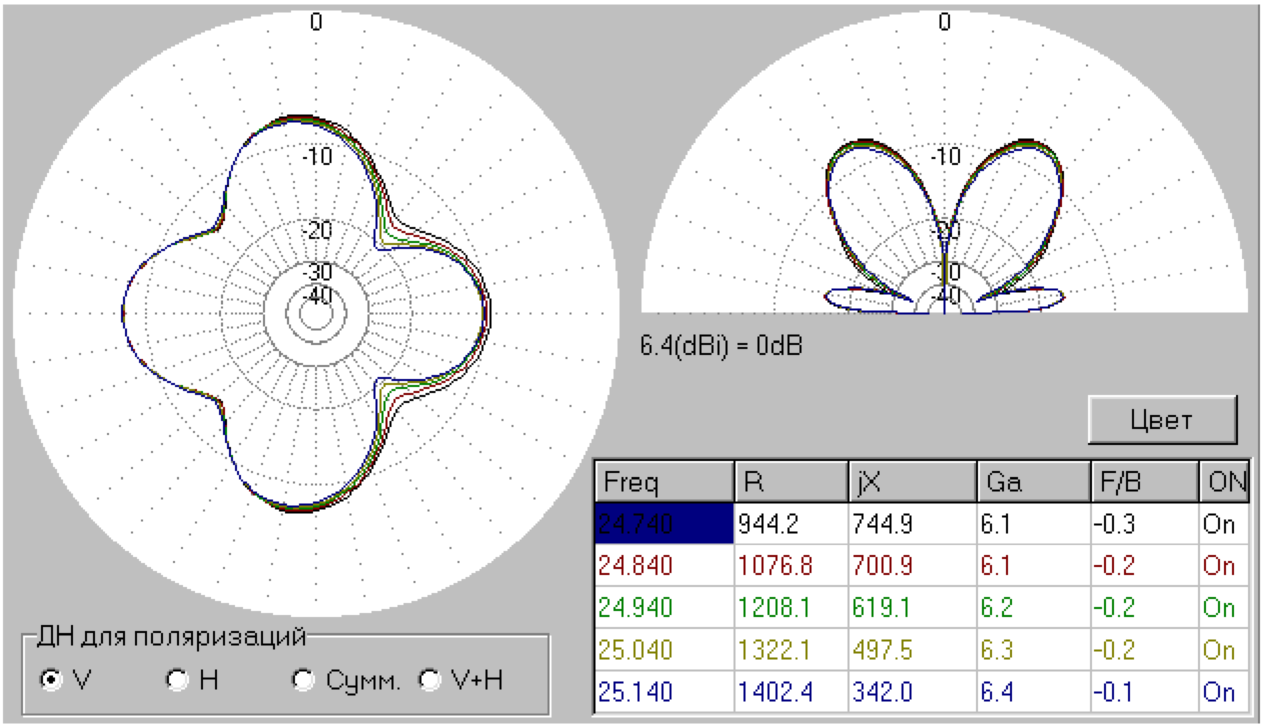
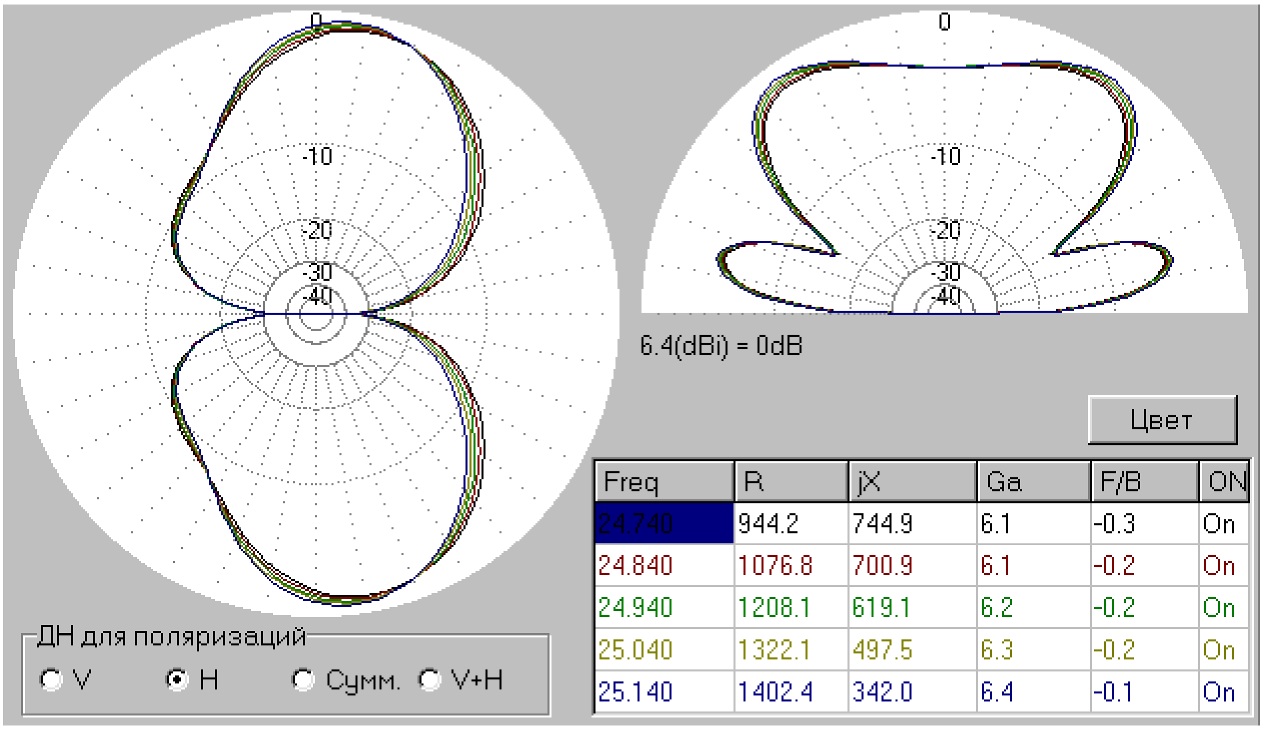
Antenna RV3DA at 12-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
24.740	944.2	744.9	6.1	-0.3	On
24.840	1076.8	700.9	6.1	-0.2	On
24.940	1208.1	619.1	6.2	-0.2	On
25.040	1322.1	497.5	6.3	-0.2	On
25.140	1402.4	342.0	6.4	-0.1	On

Horizon Radiation Pattern



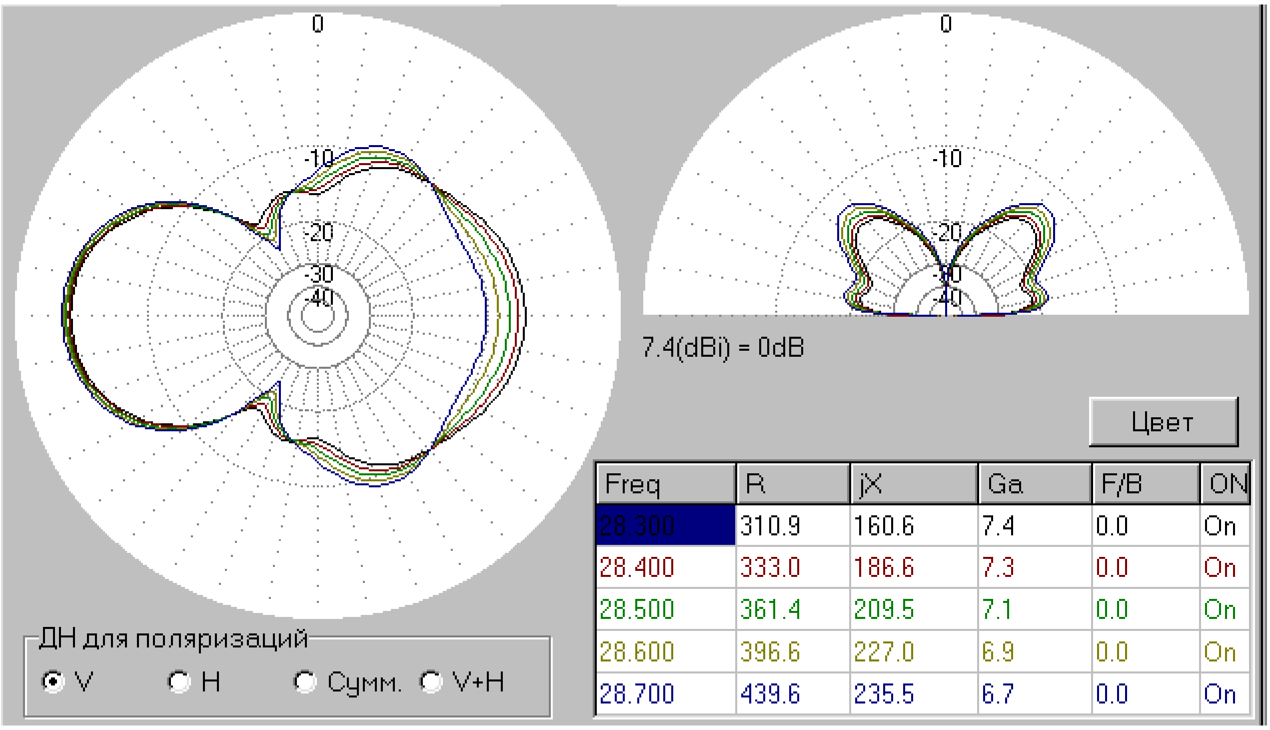
Freq	R	jX	Ga	F/B	ON
24.740	944.2	744.9	6.1	-0.3	On
24.840	1076.8	700.9	6.1	-0.2	On
24.940	1208.1	619.1	6.2	-0.2	On
25.040	1322.1	497.5	6.3	-0.2	On
25.140	1402.4	342.0	6.4	-0.1	On

Comments: Antenna has strong horizon radiation. For the horizon radiation antenna has a not bad pattern in the vertical plane, and "eight- figure" pattern in the horizon plane. Antenna can provide DX QSOs at horizon radiation. Antenna has impedance 1208+j619-Ohms at 21200-kHz. Not all ATUs do good matching for such load.

RUSSIAN DISTRICTS AWARD PROGRAM

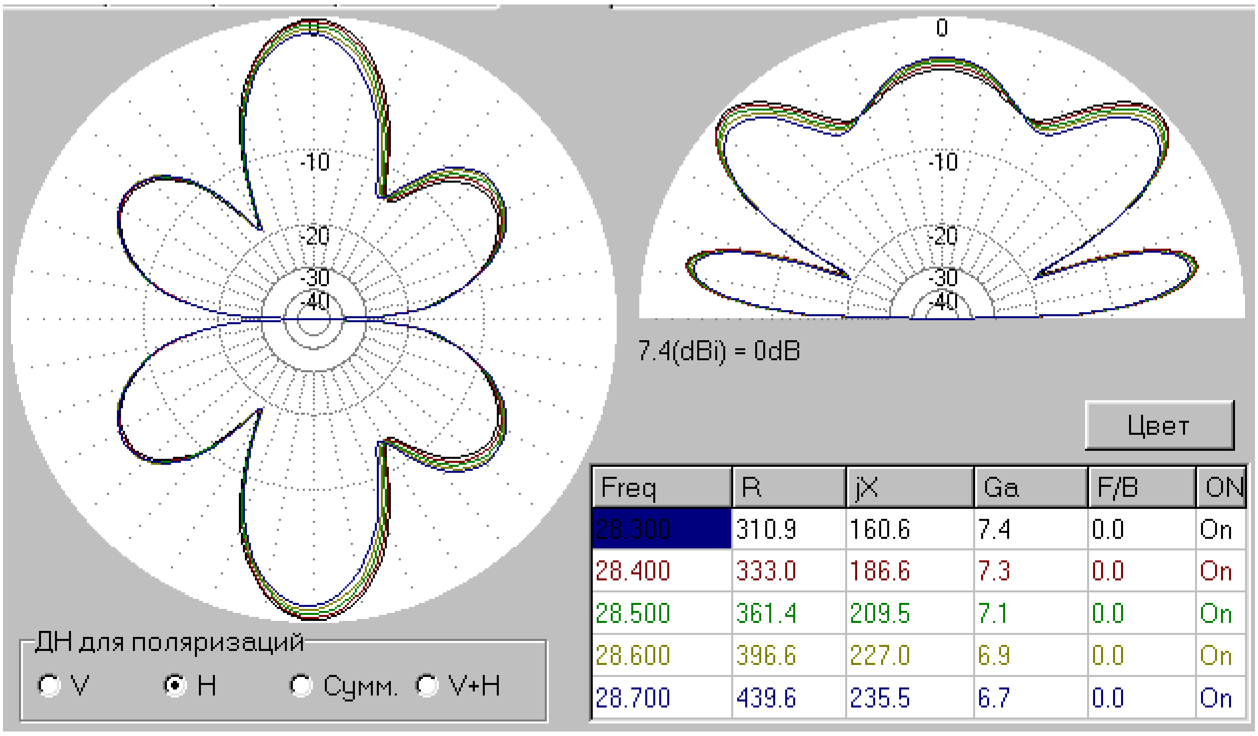
Antenna RV3DA at 10-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
28.300	310.9	160.6	7.4	0.0	On
28.400	333.0	186.6	7.3	0.0	On
28.500	361.4	209.5	7.1	0.0	On
28.600	396.6	227.0	6.9	0.0	On
28.700	439.6	235.5	6.7	0.0	On

Horizon Radiation Pattern

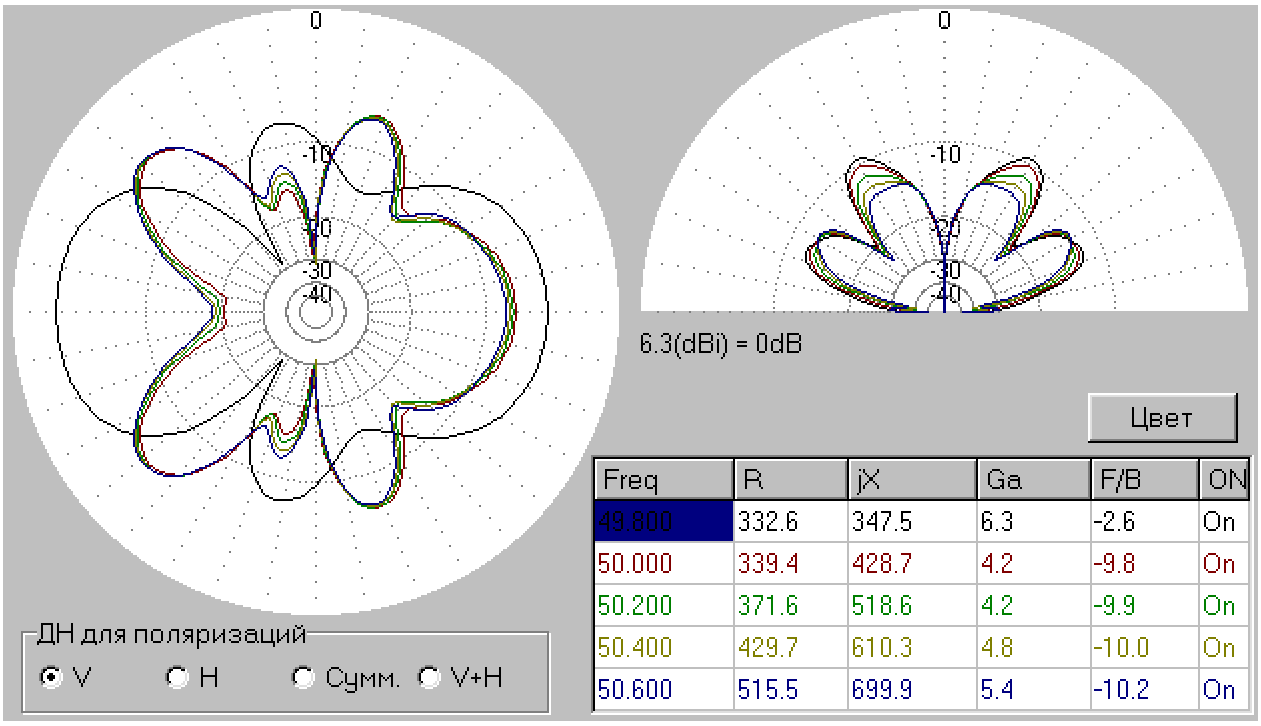


Freq	R	jX	Ga	F/B	ON
28.300	310.9	160.6	7.4	0.0	On
28.400	333.0	186.6	7.3	0.0	On
28.500	361.4	209.5	7.1	0.0	On
28.600	396.6	227.0	6.9	0.0	On
28.700	439.6	235.5	6.7	0.0	On

Comments: Antenna has strong horizon radiation. For the horizon radiation antenna has a not bad pattern in the vertical plane, and "eight- figure" pattern dropped to lobes in the horizon plane. Antenna can provide DX QSOs at the horizon radiation. Antenna has impedance 396+j227-Ohms at 28600-kHz. Not all ATUs do good matching for such load.

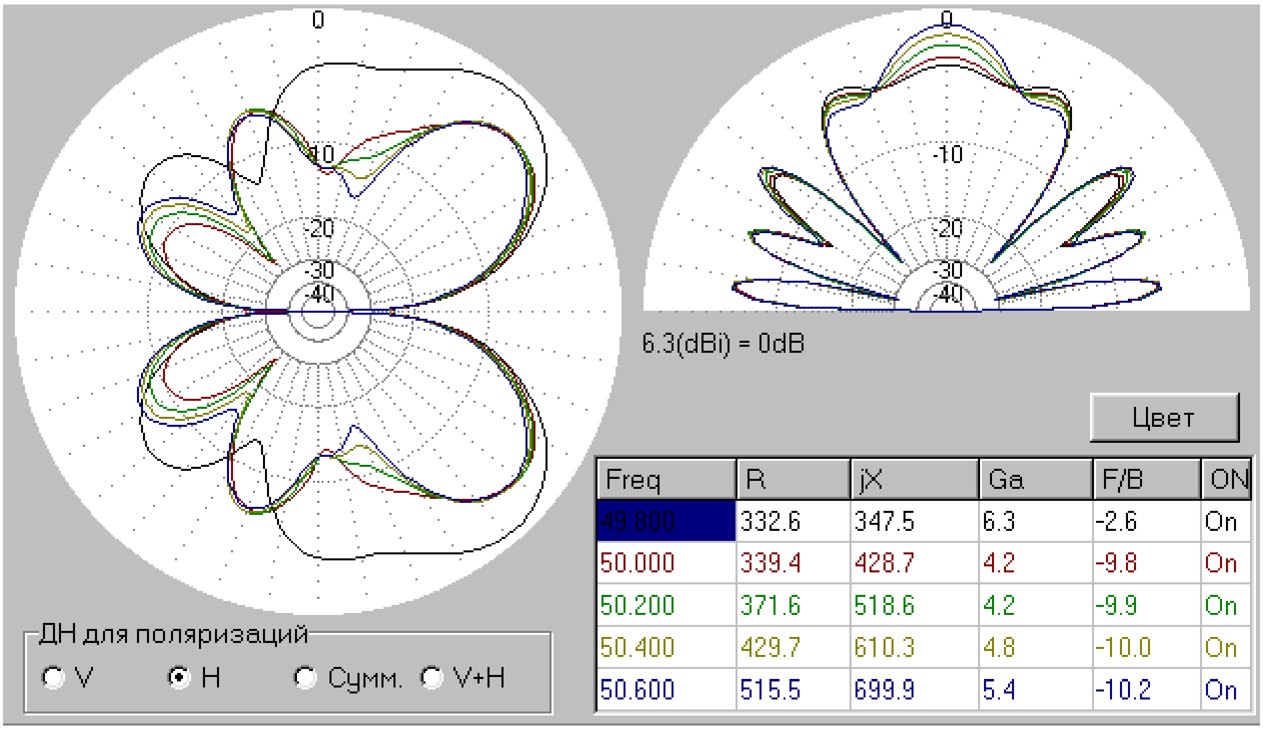
Antenna RV3DA at 6-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
49.800	332.6	347.5	6.3	-2.6	On
50.000	339.4	428.7	4.2	-9.8	On
50.200	371.6	518.6	4.2	-9.9	On
50.400	429.7	610.3	4.8	-10.0	On
50.600	515.5	699.9	5.4	-10.2	On

Horizon Radiation Pattern



Freq	R	jX	Ga	F/B	ON
49.800	332.6	347.5	6.3	-2.6	On
50.000	339.4	428.7	4.2	-9.8	On
50.200	371.6	518.6	4.2	-9.9	On
50.400	429.7	610.3	4.8	-10.0	On
50.600	515.5	699.9	5.4	-10.2	On

Comments: Antenna has horizon and vertical radiation. For the horizon radiation antenna has a not bad pattern in the vertical plane, and “eight- figure” pattern dropped to lobes in the horizon plane. Antenna can provide DX QSOs at horizon radiation. Antenna has impedance 429+j599-Ohms at 50600-kHz. Not all ATUs do good matching for such load.

SHUNT VERTICAL UNIVERSAL HF ANTENNA

Igor Grigorov, Rk3ZK

antentop@mail.ru

*Field universal antenna RV3DA (**see pp.:24- 35 of ANTENTOP- 02- 2004**) works well even at a bad grounding. To hammer into the ground a metal rod in 1 meter length is enough for the grounding. Installation of the antenna takes a little time, it is another its advantage.However, if there is an opportunity to provide a good ground, and there is some free time to spend of for installation of an antenna, it is possible to use a **Shunt Vertical Universal HF Antenna** .*

Figure 1 shows the schematic of the Shunt Vertical Universal HF Antenna. A detailed description of the theory of a Shunt Vertical Universal is given at reference **[1]**.

Apparently, the circuit of the antenna only a bit differs from field universal antenna RV3DA. The differences are: the loop is isolated from the ground, its terminals are shortened, shunts go down from two tops of the triangle loop to the ground. To ground shunts is possible as to universal antenna RV3DA it is done, i.e., a metal rod in 1 meter length is enough for the grounding. Of course, several counterpoises (three and more) in length 0f 5 meters (and more) help to improve the antenna operation. Counterpoises can lay on a surface of the ground.

Shunt Vertical Universal HF Antenna radiates mainly vertical radiation. It is required to use the antenna at woodless surrounding or big losses of high-frequency energy will be. Please, take attention Shunt Vertical Universal HF Antenna has a gain less then universal antenna RV3DA. It is possible to do a design of the Shunt Vertical Universal HF Antenna so, that this one can be easy turned to the field universal antenna RV3DA.

Below given diagram directivity for the antenna obtained with help of free antenna program MMANA (MININEC based). Left diagram is a section of the volumetric diagram directivity of plane X-Y at a zenith corner of the maximum radiation. The right diagram is section of the volumetric diagram directivity of plane X-Z. Also at the right down corner of the pictures is a table with antenna impedance. Please, take attention to the data, you can do decision how you ATU does match of the

Reference:

1. Aizenberg G. Z. Antennas of Short Waves.: Moscow, "Svyaz", 1985.

73!
Igor Grigorov, RK3ZK

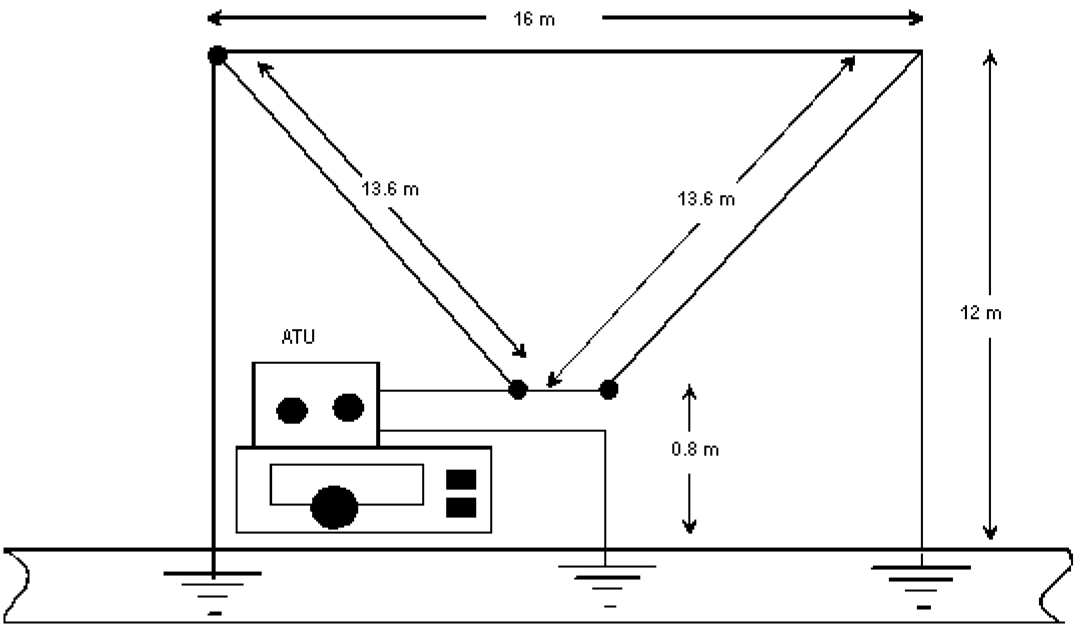
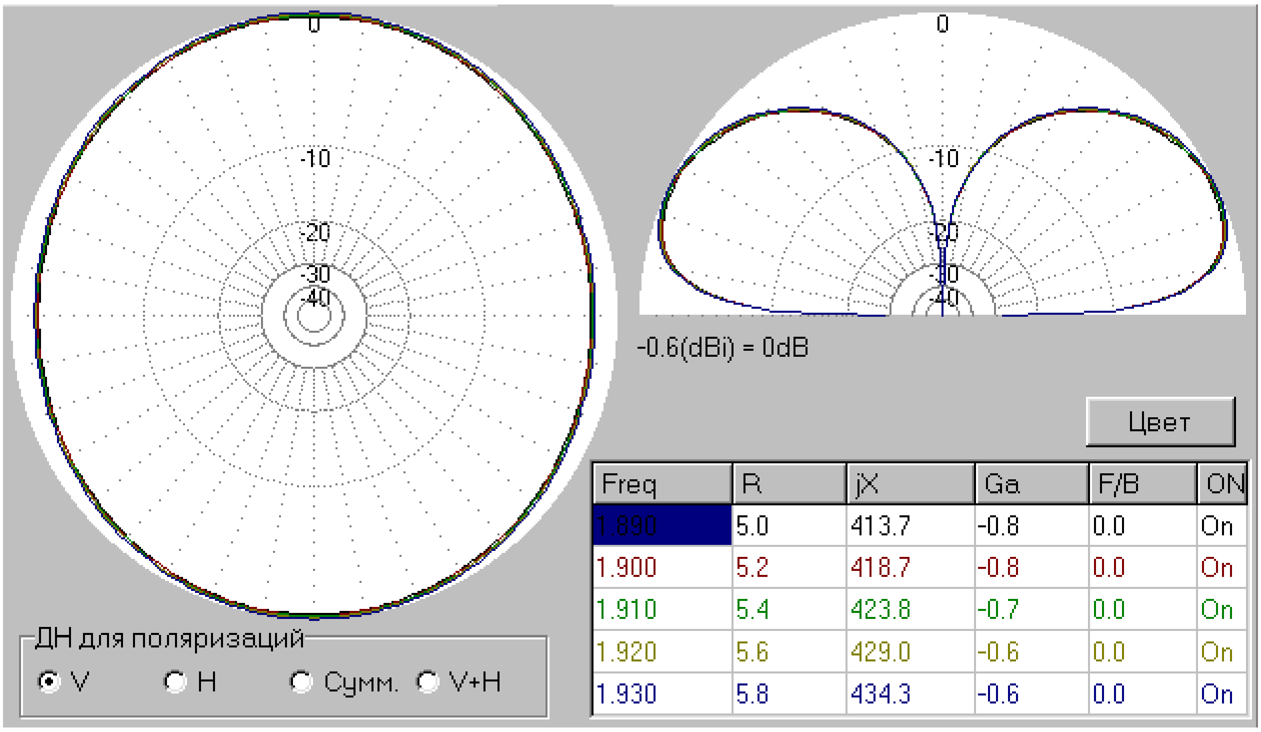


Figure 1

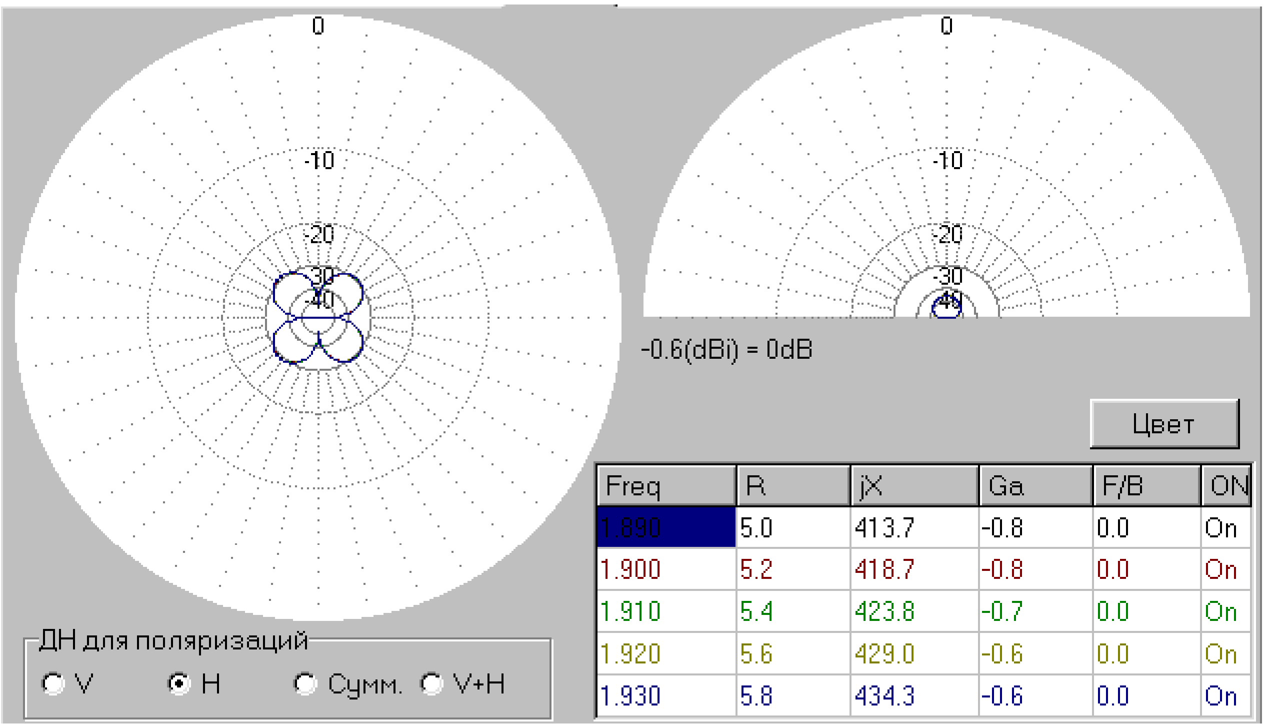
Shunt Vertical Universal HF Antenna at 160-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
1.890	5.0	413.7	-0.8	0.0	On
1.900	5.2	418.7	-0.8	0.0	On
1.910	5.4	423.8	-0.7	0.0	On
1.920	5.6	429.0	-0.6	0.0	On
1.930	5.8	434.3	-0.6	0.0	On

Horizon Radiation Pattern

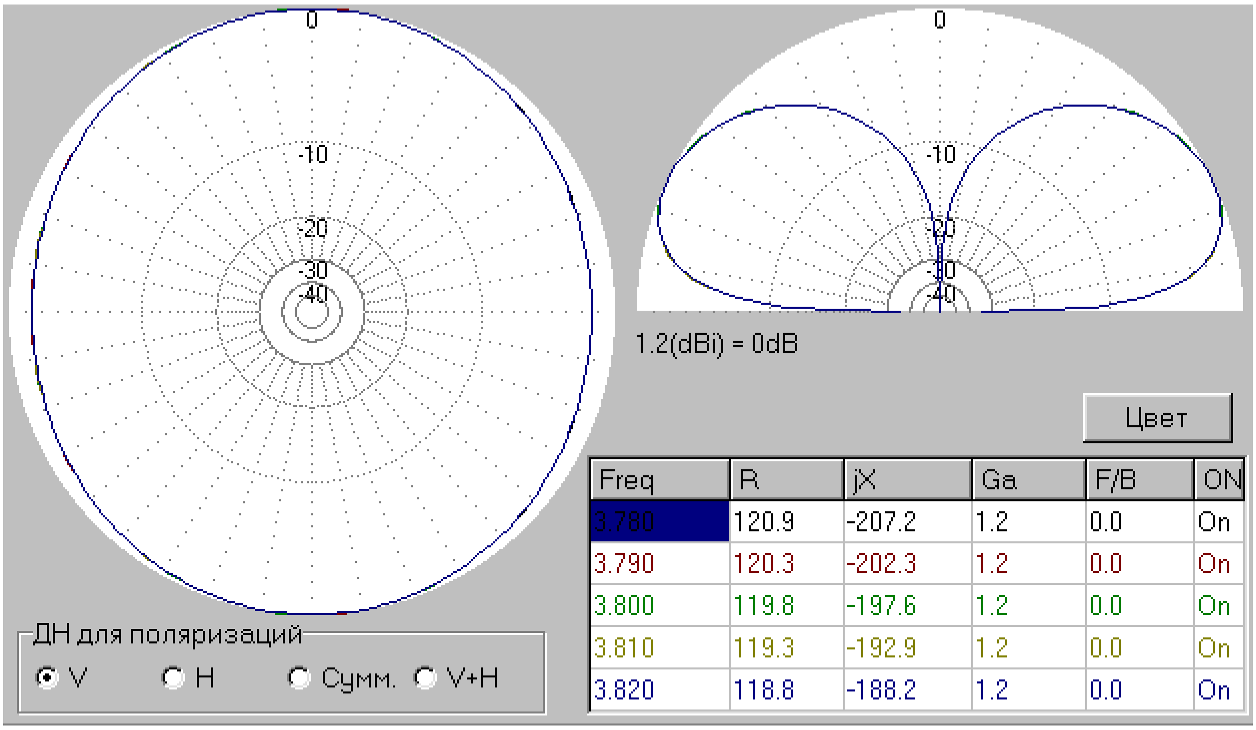


Freq	R	jX	Ga	F/B	ON
1.890	5.0	413.7	-0.8	0.0	On
1.900	5.2	418.7	-0.8	0.0	On
1.910	5.4	423.8	-0.7	0.0	On
1.920	5.6	429.0	-0.6	0.0	On
1.930	5.8	434.3	-0.6	0.0	On

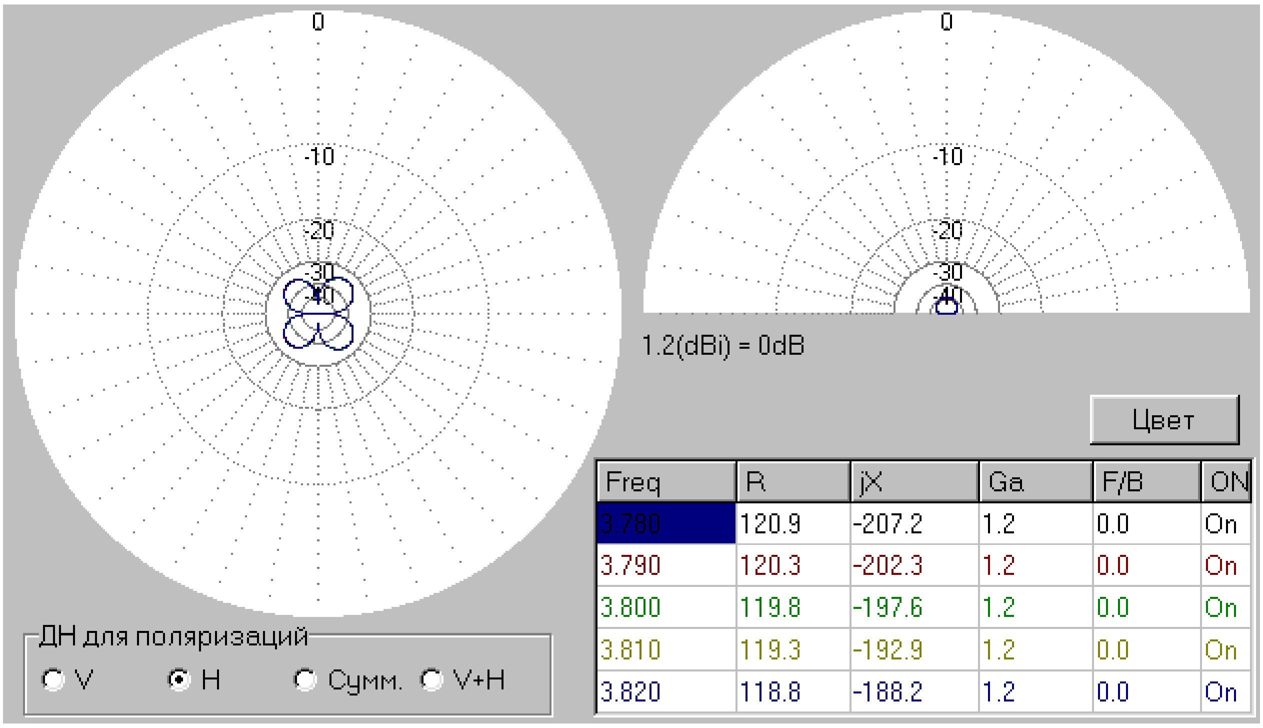
Comments: Antenna radiates radio waves with vertical polarization. A very good pattern with low lobes in the vertical plane. Circular pattern in horizontal plane. It is fine for DX- QSO. But antenna has Z= 5.4+ j423-Ohms at 1910-kHz. Not all ATUs do good matching for such load.

Shunt Vertical Universal HF Antenna at 80-m

Vertical Radiation Pattern



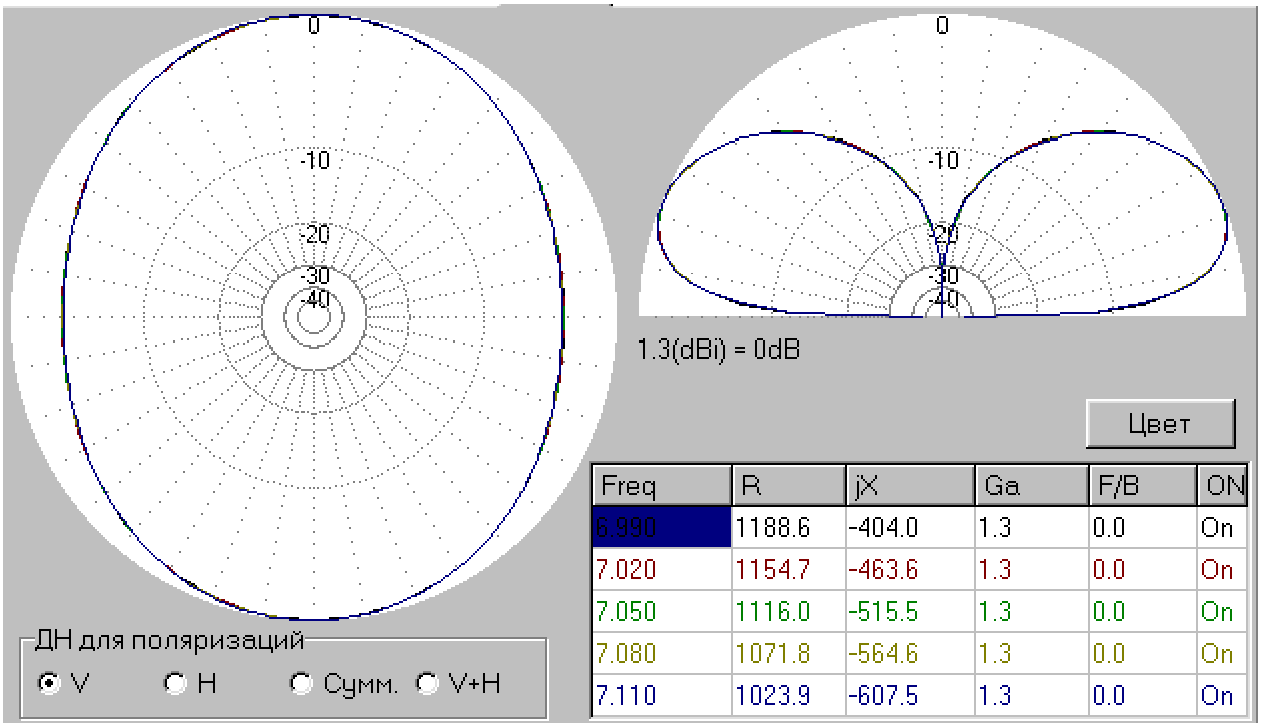
Horizon Radiation Pattern



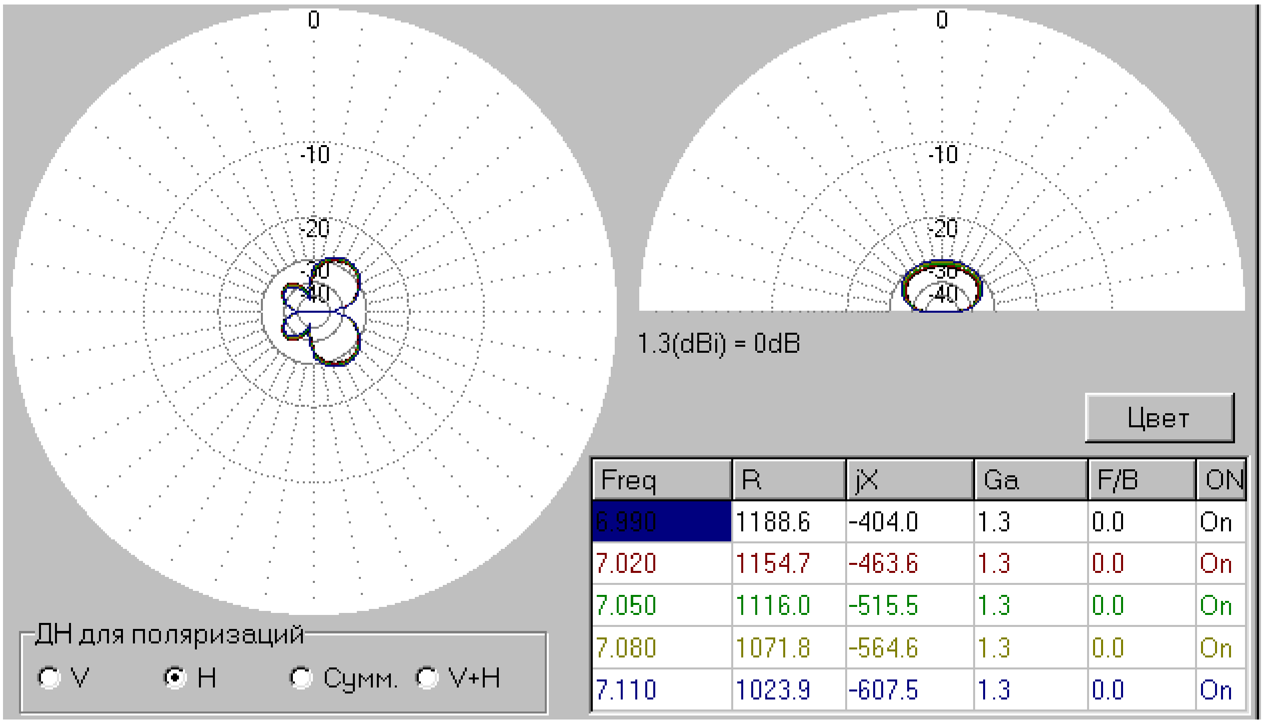
Comments: Antenna radiates radio waves with vertical polarization. A very good pattern with low lobes in the vertical plane. Circular pattern in horizontal plane. It is fine for DX- QSO. Antenna has Z= 119-j197-Ohms at 3800-kHz. Almost any ATU does good matching for such load.

Shunt Vertical Universal HF Antenna at 40-m

Vertical Radiation Pattern



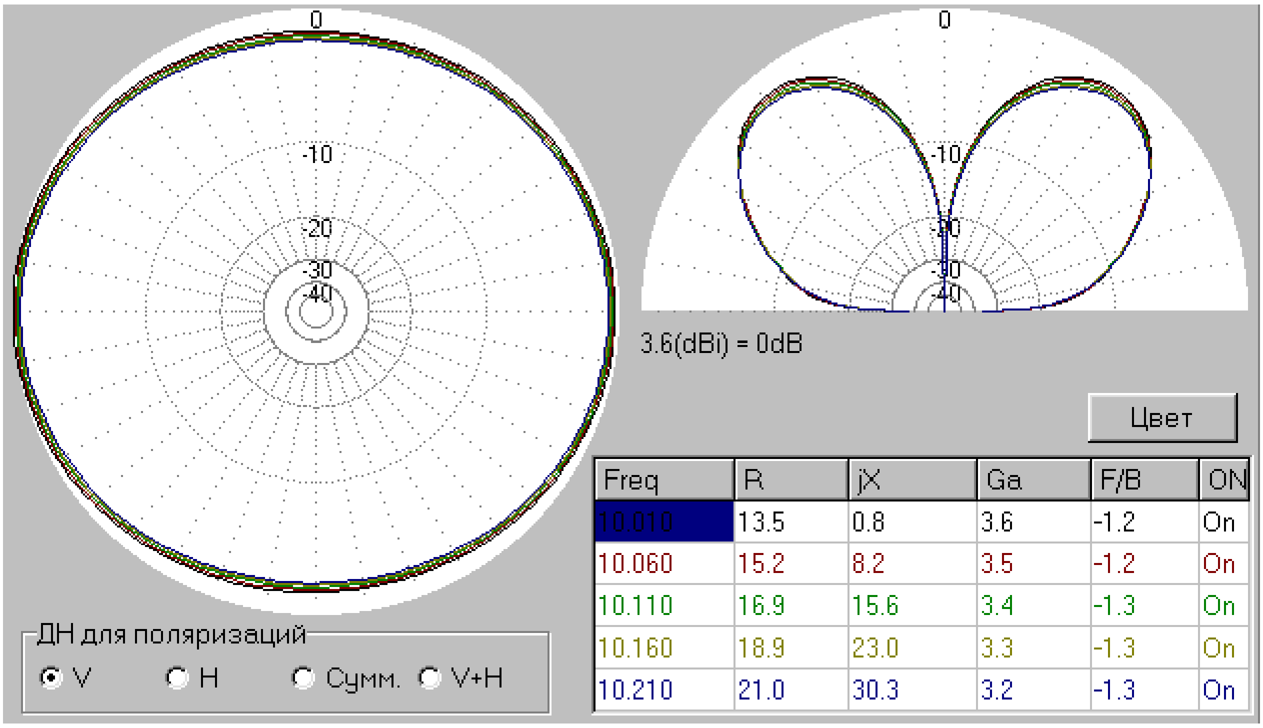
Horizon Radiation Pattern



Comments: Antenna radiates radio waves with vertical polarization. A very good pattern with low lobes in the vertical plane. Almost a circular pattern in horizontal plane. It is fine for DX- QSO. Antenna has Z=1116- j515-Ohms at 7050-kHz. Not all ATUs do good matching for such load.

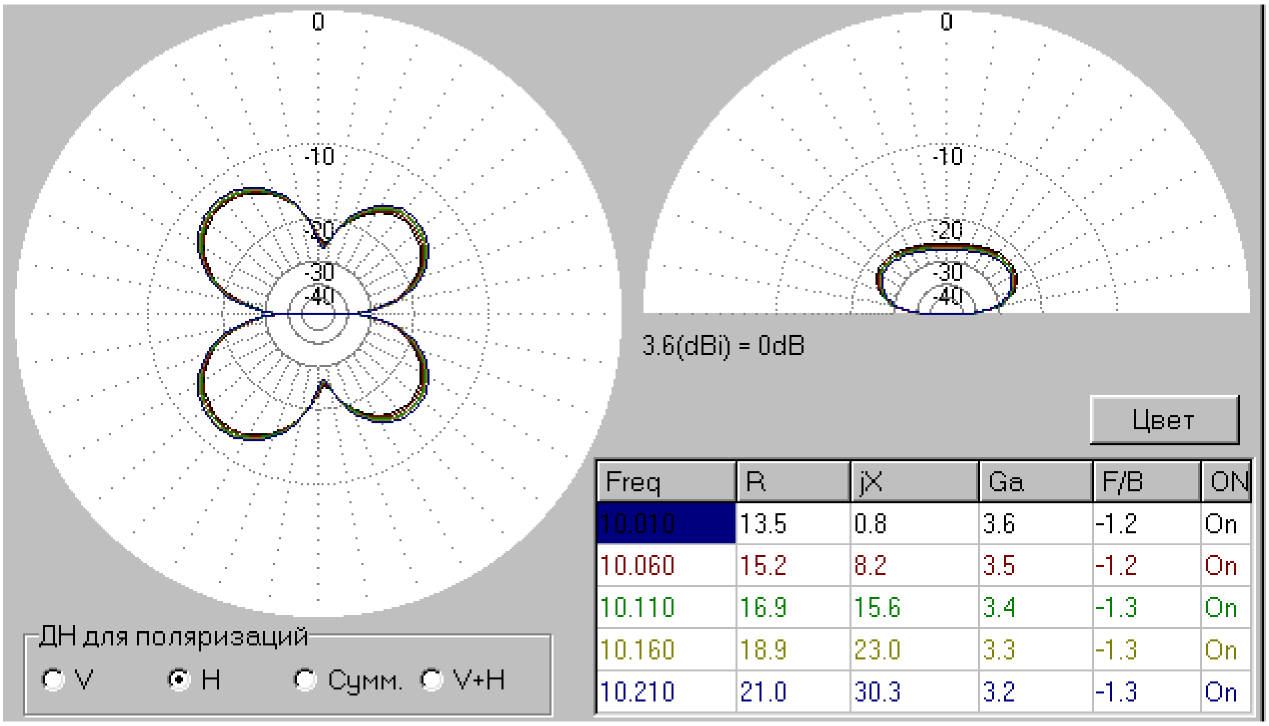
Shunt Vertical Universal HF Antenna at 30-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
10.010	13.5	0.8	3.6	-1.2	On
10.060	15.2	8.2	3.5	-1.2	On
10.110	16.9	15.6	3.4	-1.3	On
10.160	18.9	23.0	3.3	-1.3	On
10.210	21.0	30.3	3.2	-1.3	On

Horizon Radiation Pattern

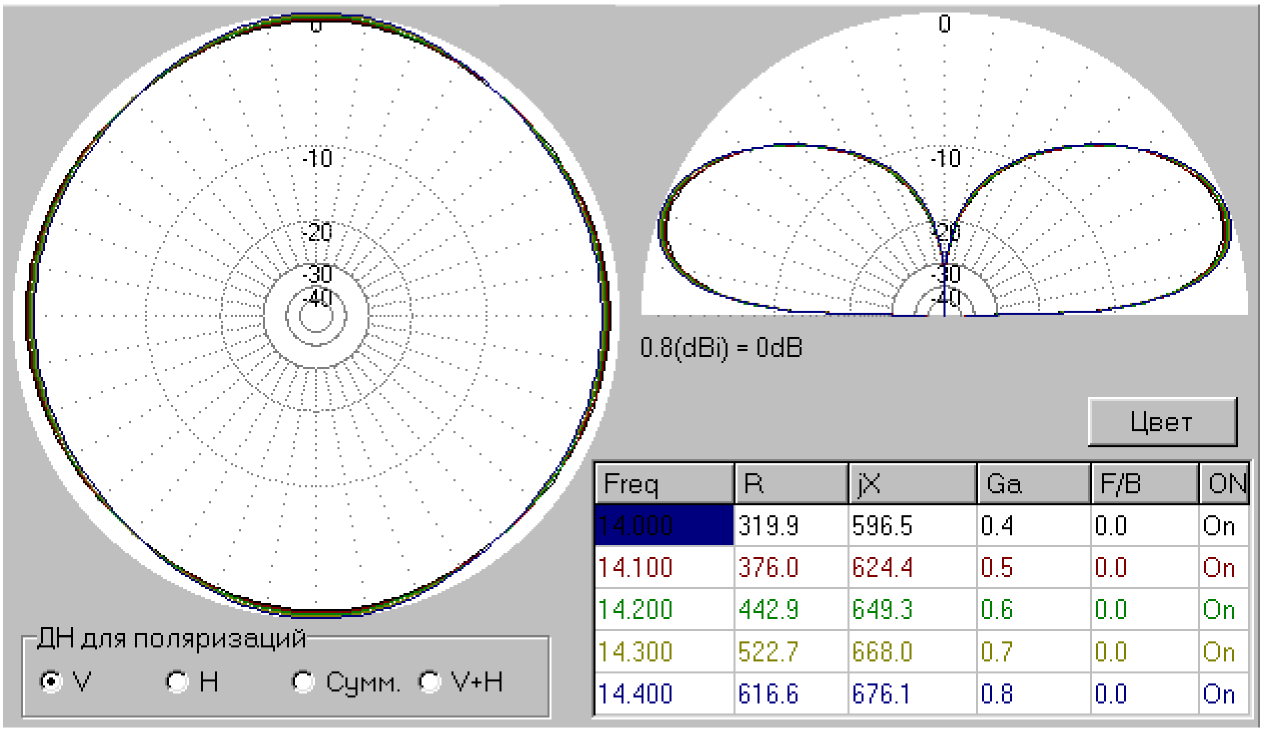


Freq	R	jX	Ga	F/B	ON
10.010	13.5	0.8	3.6	-1.2	On
10.060	15.2	8.2	3.5	-1.2	On
10.110	16.9	15.6	3.4	-1.3	On
10.160	18.9	23.0	3.3	-1.3	On
10.210	21.0	30.3	3.2	-1.3	On

Comments: Antenna has strong vertical radiation. A good pattern in the vertical plane. Antenna has strong radiation at high corners that allows to do local QSOs. Antenna has almost circular pattern in horizontal plane. Antenna provides DX and local QSOs. Antenna has Z= 16.9+ j15.6-Ohms at 10110-kHz. Any ATU does good matching for such load.

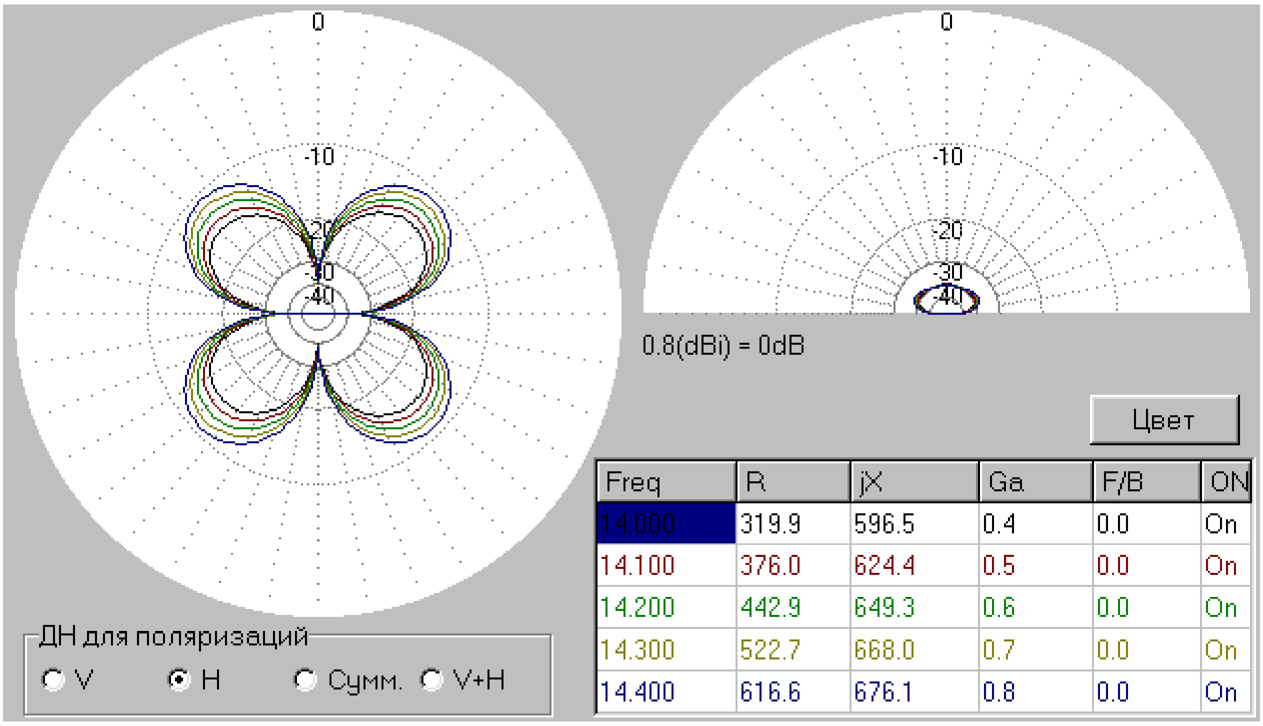
Shunt Vertical Universal HF Antenna at 20-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
14.000	319.9	596.5	0.4	0.0	On
14.100	376.0	624.4	0.5	0.0	On
14.200	442.9	649.3	0.6	0.0	On
14.300	522.7	668.0	0.7	0.0	On
14.400	616.6	676.1	0.8	0.0	On

Horizon Radiation Pattern

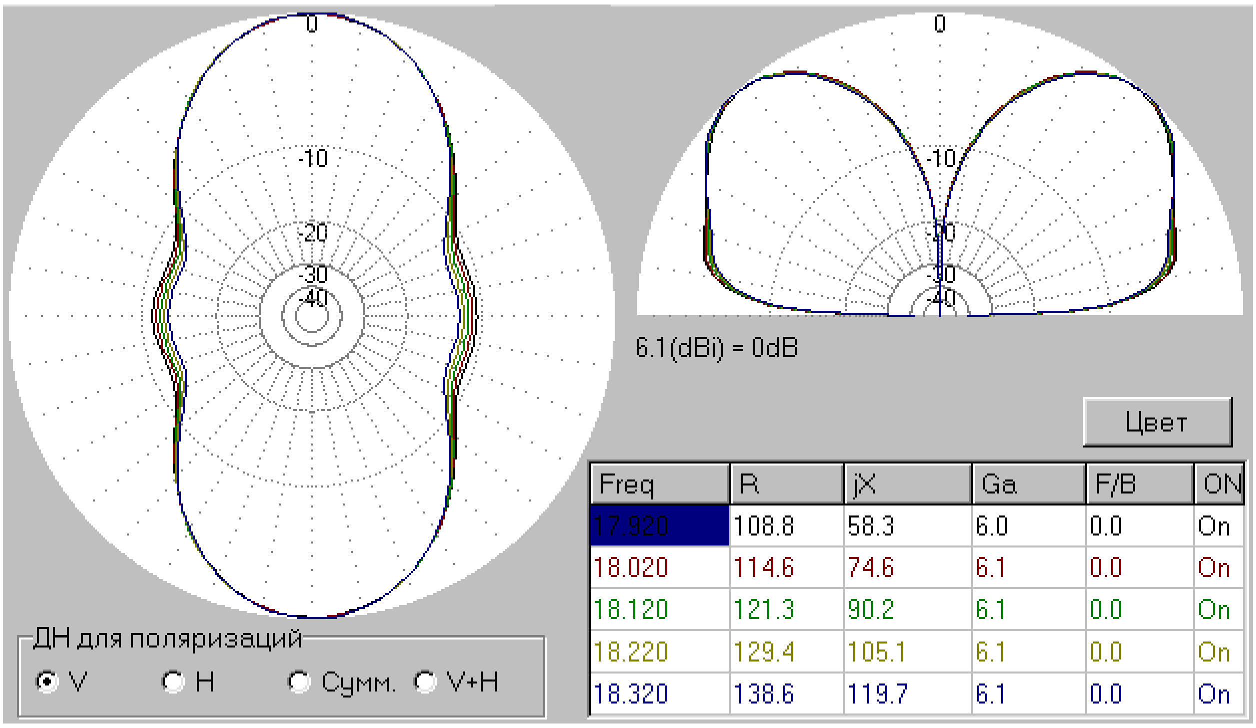


Freq	R	jX	Ga	F/B	ON
14.000	319.9	596.5	0.4	0.0	On
14.100	376.0	624.4	0.5	0.0	On
14.200	442.9	649.3	0.6	0.0	On
14.300	522.7	668.0	0.7	0.0	On
14.400	616.6	676.1	0.8	0.0	On

Comments: Antenna has strong vertical radiation. A very good pattern in the vertical plane. Antenna has almost circular pattern in horizontal plane. Antenna provides DX QSOs. Antenna has Z= 442+ j649-Ohms at 14200-kHz. Not all ATUs do good matching for such load.

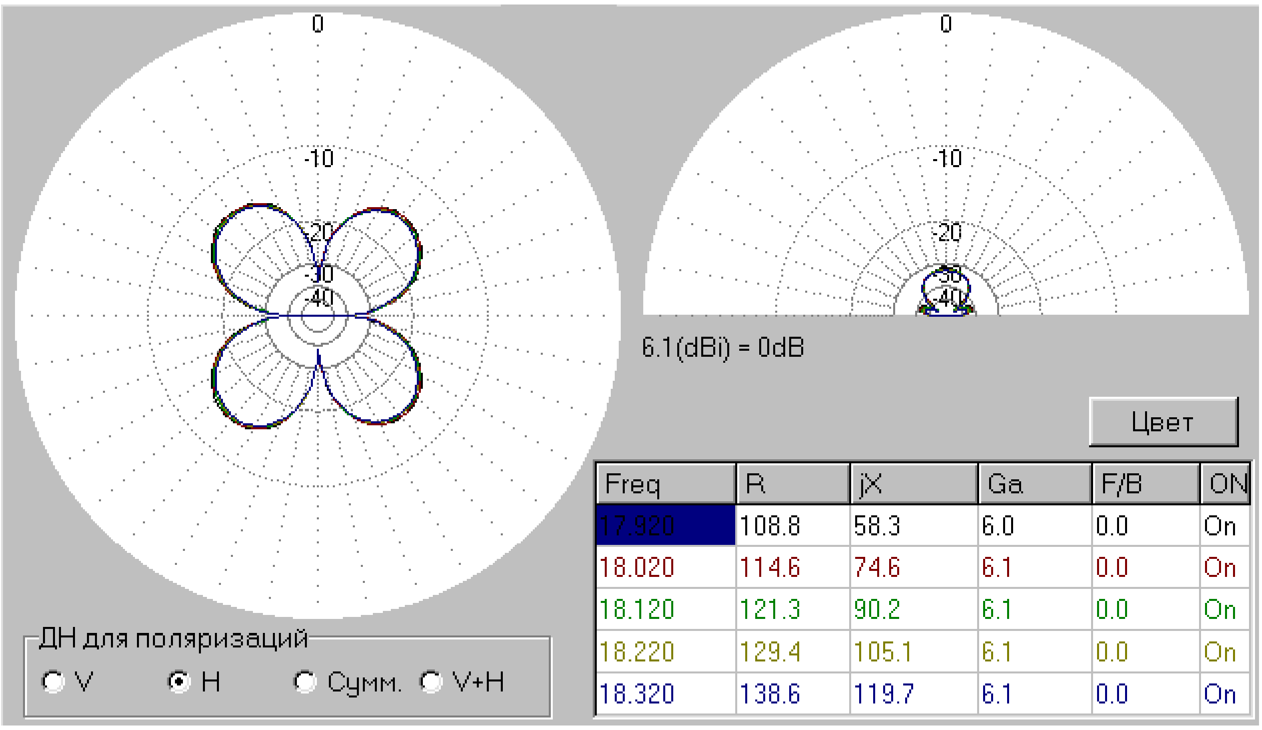
Shunt Vertical Universal HF Antenna at 17-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
17.920	108.8	58.3	6.0	0.0	On
18.020	114.6	74.6	6.1	0.0	On
18.120	121.3	90.2	6.1	0.0	On
18.220	129.4	105.1	6.1	0.0	On
18.320	138.6	119.7	6.1	0.0	On

Horizon Radiation Pattern

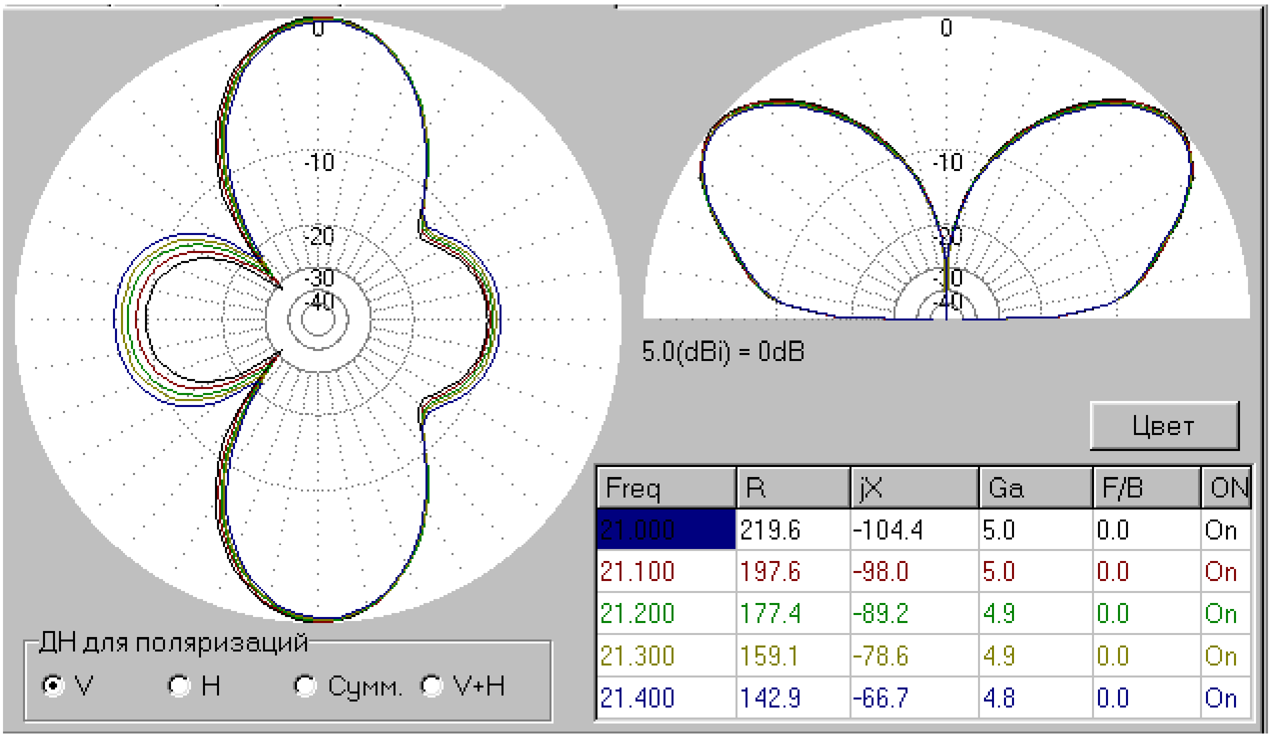


Freq	R	jX	Ga	F/B	ON
17.920	108.8	58.3	6.0	0.0	On
18.020	114.6	74.6	6.1	0.0	On
18.120	121.3	90.2	6.1	0.0	On
18.220	129.4	105.1	6.1	0.0	On
18.320	138.6	119.7	6.1	0.0	On

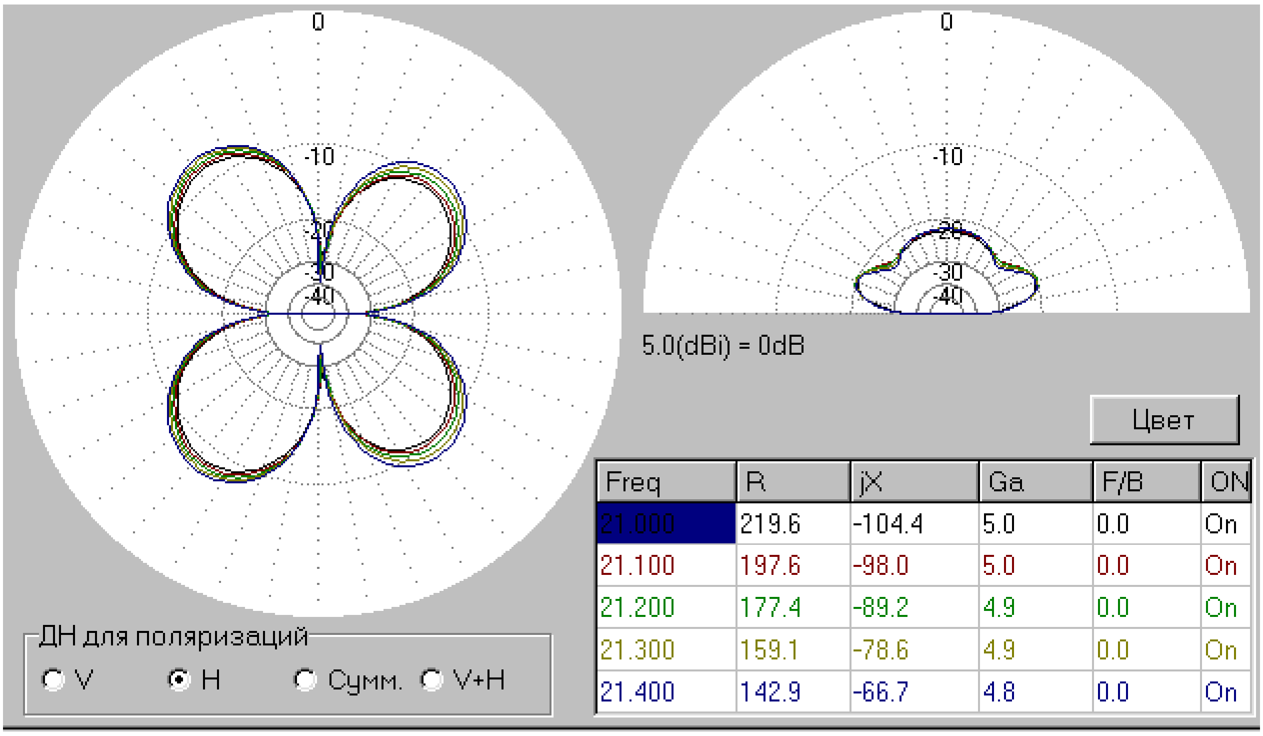
Comments: Antenna has strong vertical radiation. A good pattern in the vertical plane. Antenna has egg shape pattern in horizontal plane, so, it demands to choose a proper direction before an installation of the antenna. Antenna provides DX QSOs. Antenna has Z= 121+ j90-Ohms at 18120-kHz. Any ATU does good matching for such load.

Shunt Vertical Universal HF Antenna at 15-m

Vertical Radiation Pattern



Horizon Radiation Pattern

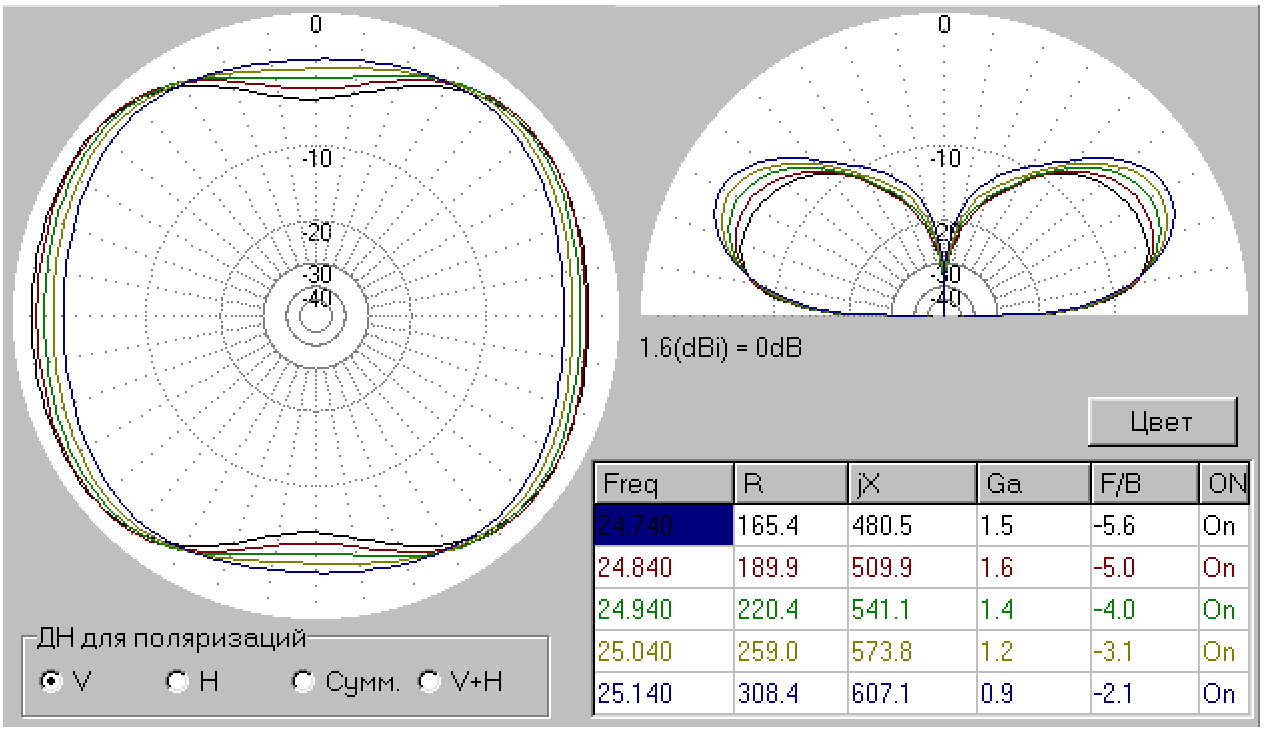


Comments: Antenna has strong vertical radiation. A good pattern in the vertical plane. Antenna has almost egg shape pattern dropped to four lobes in horizontal plane, so, it demands to choose a proper direction before an installation of the antenna. Antenna provides DX QSOs. Antenna has Z= 177- j89-Ohms at 21200-kHz. Any ATU does good matching for such load.

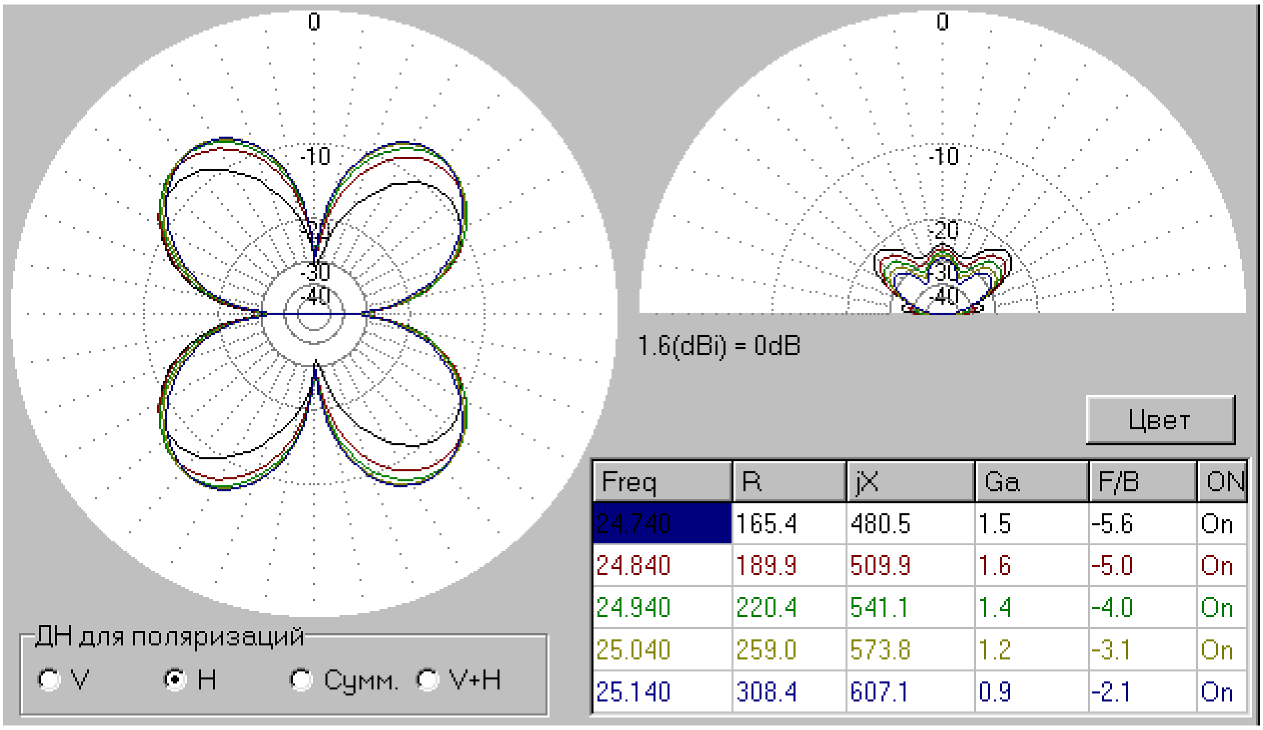
RUSSIAN DISTRICTS AWARD PROGRAM

Shunt Vertical Universal HF Antenna at 12-m

Vertical Radiation Pattern



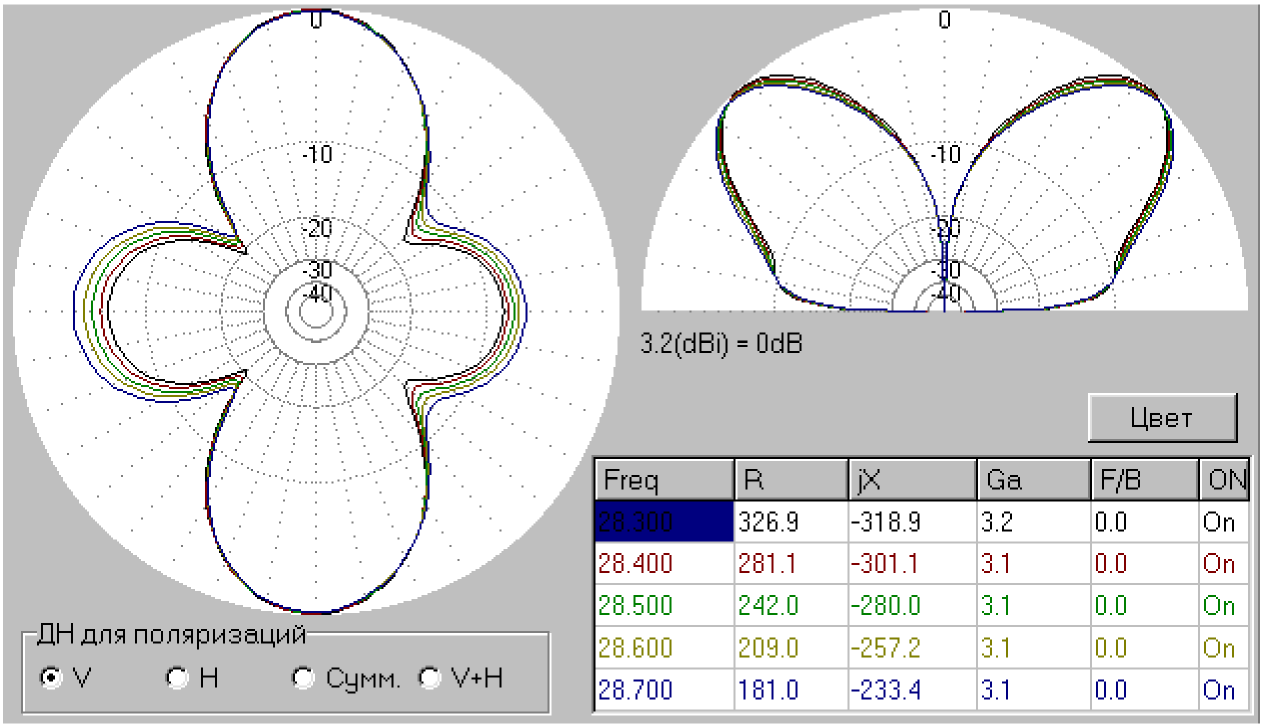
Horizon Radiation Pattern



Comments: Antenna has strong vertical radiation. A good pattern in the vertical plane. Antenna has almost circular pattern in horizontal plane. Antenna provides DX QSOs. Antenna has Z= 259- j573-Ohms at 25040-kHz. Not all ATUs do good matching for such load.

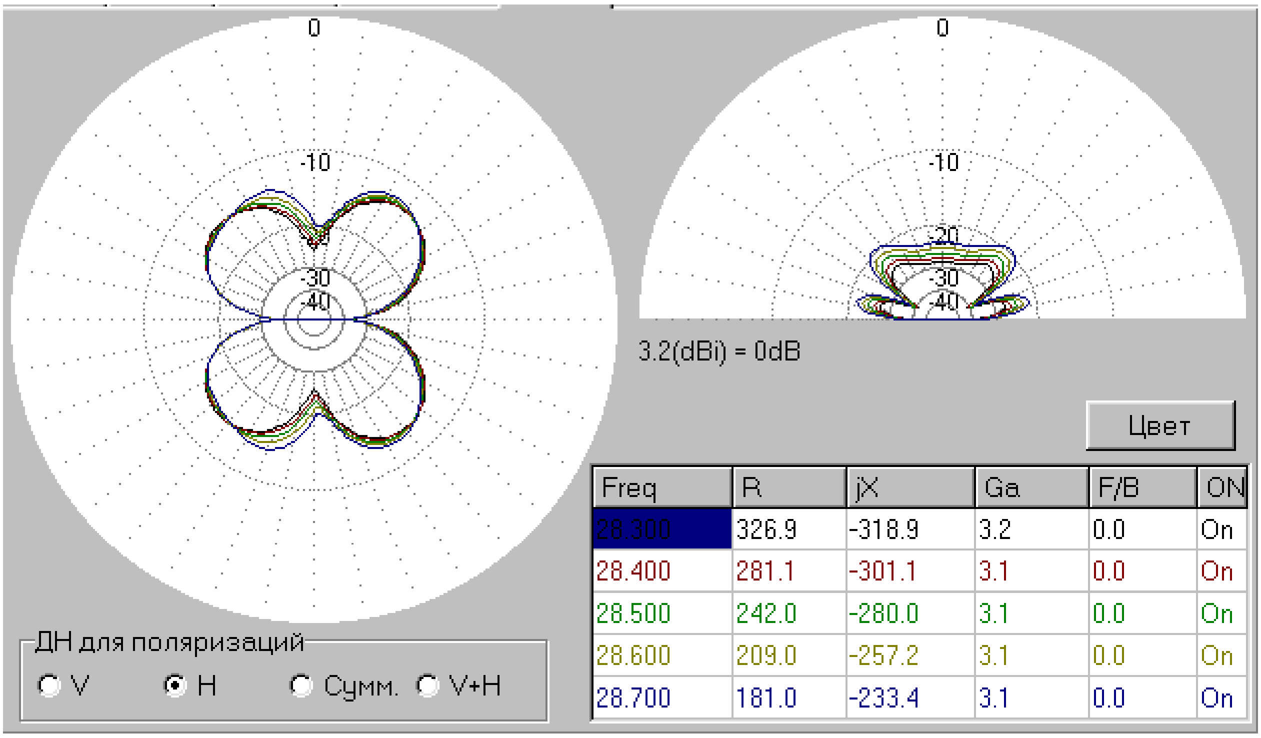
Shunt Vertical Universal HF Antenna at 10-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
28.300	326.9	-318.9	3.2	0.0	On
28.400	281.1	-301.1	3.1	0.0	On
28.500	242.0	-280.0	3.1	0.0	On
28.600	209.0	-257.2	3.1	0.0	On
28.700	181.0	-233.4	3.1	0.0	On

Horizon Radiation Pattern

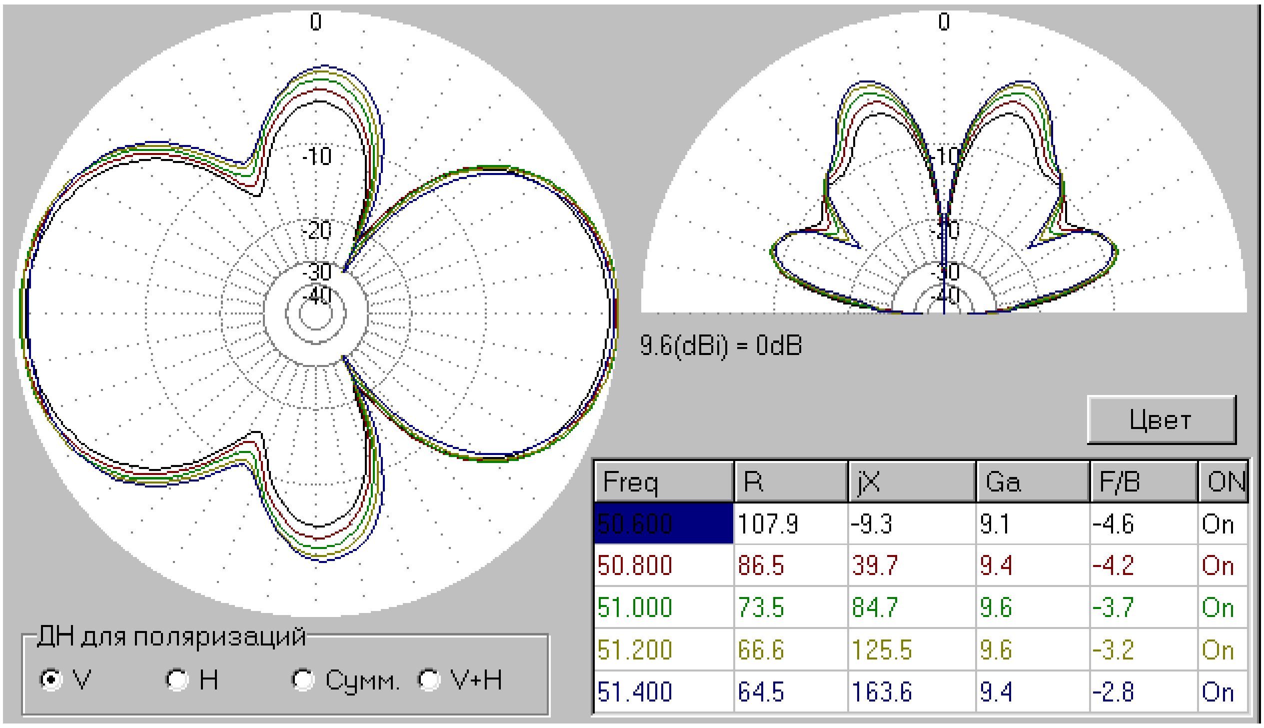


Freq	R	jX	Ga	F/B	ON
28.300	326.9	-318.9	3.2	0.0	On
28.400	281.1	-301.1	3.1	0.0	On
28.500	242.0	-280.0	3.1	0.0	On
28.600	209.0	-257.2	3.1	0.0	On
28.700	181.0	-233.4	3.1	0.0	On

Comments: Antenna has strong vertical radiation. A not bad pattern in the vertical plane. Antenna has a four- shaped lobes pattern in horizontal plane, so, it demands to choose a proper direction before an installation of the antenna.. Antenna can provide DX QSOs. Antenna has Z= 242- j280-Ohms at 28500-kHz. Any ATU does good matching for such load.

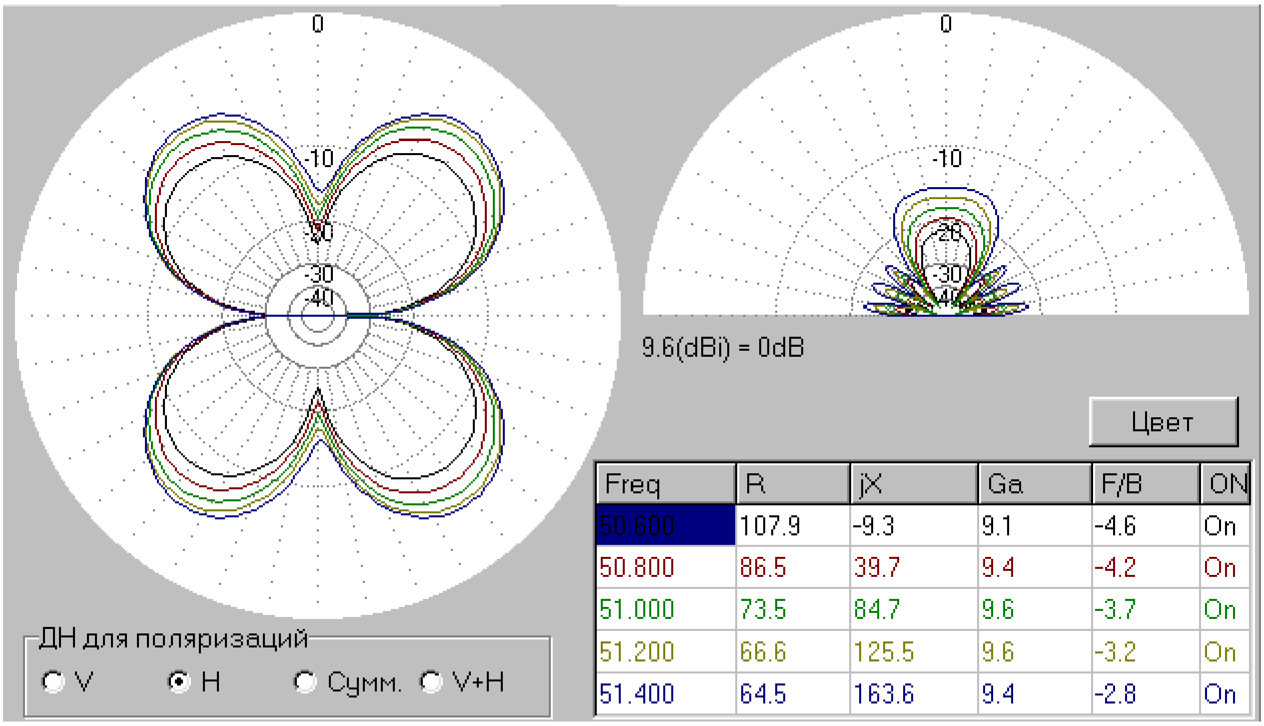
Shunt Vertical Universal HF Antenna at 6-m

Vertical Radiation Pattern



Freq	R	jX	Ga	F/B	ON
50.600	107.9	-9.3	9.1	-4.6	On
50.800	86.5	39.7	9.4	-4.2	On
51.000	73.5	84.7	9.6	-3.7	On
51.200	66.6	125.5	9.6	-3.2	On
51.400	64.5	163.6	9.4	-2.8	On

Horizon Radiation Pattern



Freq	R	jX	Ga	F/B	ON
50.600	107.9	-9.3	9.1	-4.6	On
50.800	86.5	39.7	9.4	-4.2	On
51.000	73.5	84.7	9.6	-3.7	On
51.200	66.6	125.5	9.6	-3.2	On
51.400	64.5	163.6	9.4	-2.8	On

Comments: Antenna has strong vertical radiation. A not bad pattern in the vertical plane. Antenna has an “eight- shape” pattern in horizontal plane, so, it demands to choose a proper direction before an installation of the antenna.. Antenna can provide DX QSOs. Antenna has Z= 86+ j40-Ohms at 50800-kHz. The resonance is at the 6- meters band. Any ATU does good matching for such load.

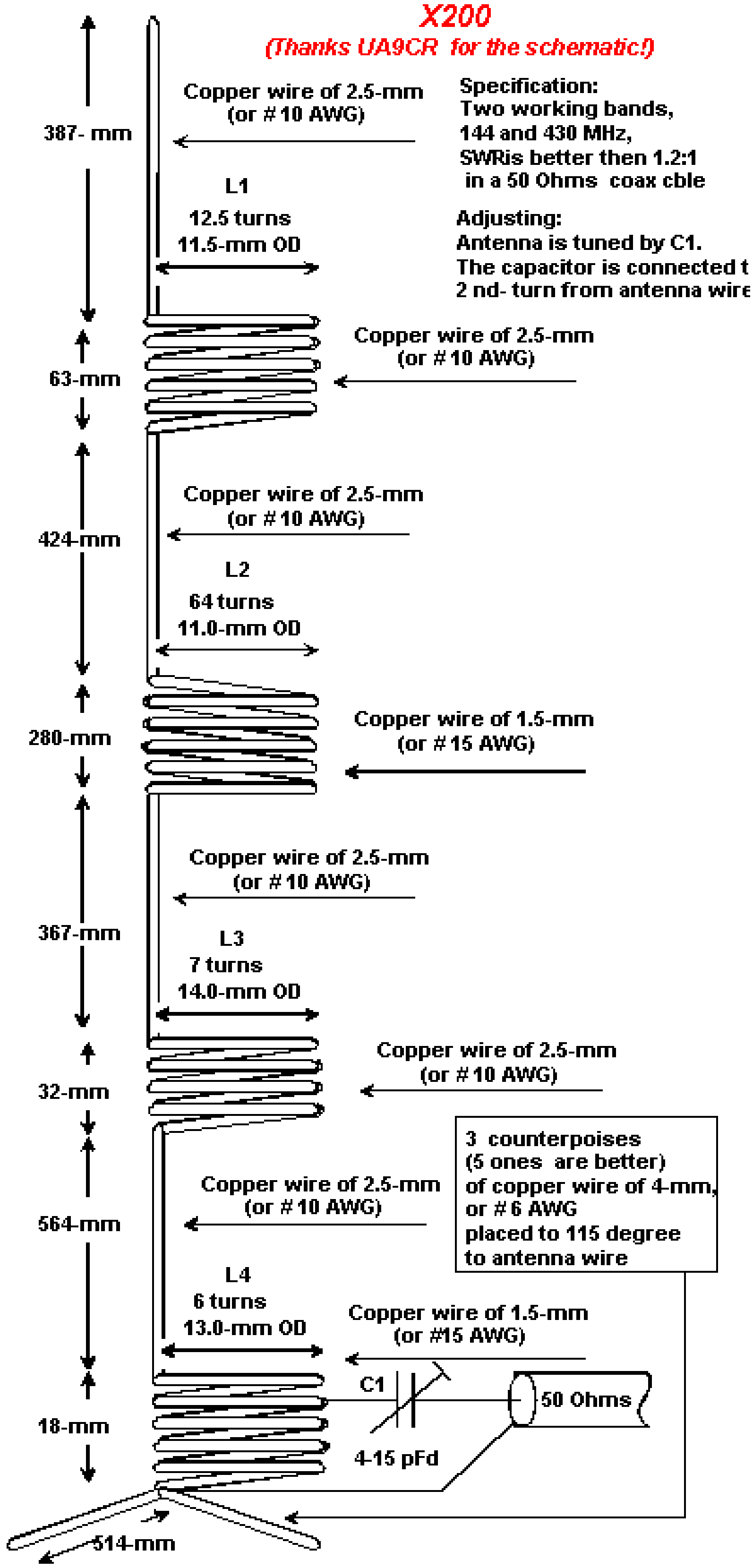
CHAPTER 2

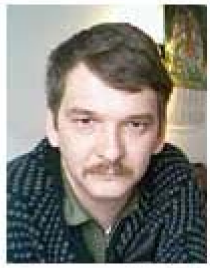
VHF ANTENNAS

Antenna X200

X200

(Thanks UA9CR for the schematic!)





Александр UA9CR

Dear Friends,

Most of us are heard about VHF antenna X200. It is very interesting and very reliable two bands antenna.

RV9CX made some modifications for the antenna, so, the new RV9CX-X200 is more suitable for doing at amateur conditions. Go to the next page for the new antenna!

Comments about the antenna please send to Dmitriy, RV9CX: rscs@rosteck-msi.ru

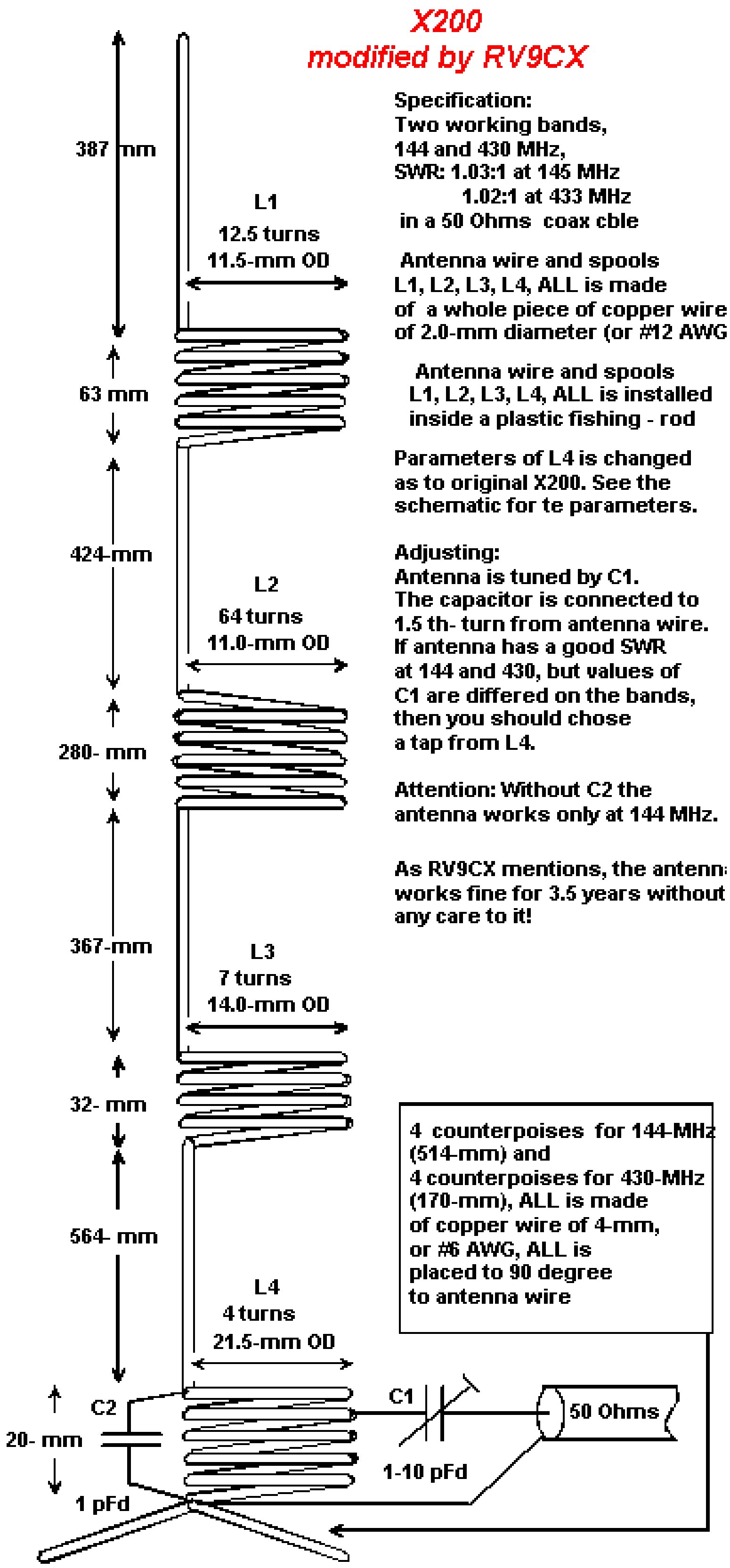
Also, you can visit to

www.znuki.ru

CLUB-X
X = Ь = та ти ти та

The site, where are Dmitriy and his friends

DX X-HAMRADIO ИКС
KENWOOD TS-950SDX XXX-VIDEO
X-РАДИОСПОРТ X-CALL


X200
modified by RV9CX
Specification:
Two working bands,
144 and 430 MHz,
SWR: 1.03:1 at 145 MHz
1.02:1 at 433 MHz
in a 50 Ohms coax cble
Antenna wire and spools
L1, L2, L3, L4, ALL is made
of a whole piece of copper wire
of 2.0-mm diameter (or #12 AWG
Antenna wire and spools
L1, L2, L3, L4, ALL is installed
inside a plastic fishing - rod
Parameters of L4 is changed
as to original X200. See the
schematic for te parameters.
Adjusting:
Antenna is tuned by C1.
The capacitor is connected to
1.5 th- turn from antenna wire.
If antenna has a good SWR
at 144 and 430, but values of
C1 are differed on the bands,
then you should chose
a tap from L4.
Attention: Without C2 the
antenna works only at 144 MHz.
As RV9CX mentions, the antenn
works fine for 3.5 years without
any care to it!
387 mm
L1
12.5 turns
11.5-mm OD
63 mm
424-mm
L2
64 turns
11.0-mm OD
280- mm
367-mm
L3
7 turns
14.0-mm OD
32- mm
564- mm
L4
4 turns
21.5-mm OD
4 counterpoises for 144-MHz
(514-mm) and
4 counterpoises for 430-MHz
(170-mm), ALL is made
of copper wire of 4-mm,
or #6 AWG, ALL is
placed to 90 degree
to antenna wire
C2
20- mm
1 pFd
C1
1-10 pFd
50 Ohms


АВГУСТА в
XII
RV9CX

"Bottle" Antenna for 145 MHz

By Sergey Mironov, RA1TW

Any amateur can do the antenna during one hour. To do the antenna takes a half of hour and to tune the antenna also takes a half of hour. So, do not waste time and go to make the Bottle Antenna!

At first take a look at schematic of the Bottle Antenna (**Figure 1**).

Specification:

1. Dielectric plate, approximately of 80x250-mm.
2. Vibrator, (5/8)λ
3. Matching spool
4. Tinned plate, approximately of 25x35-mm.
5. Counterpoises, (1/4)λ
6. Stud, washers, screw-nuts
7. Coaxial cable

How to do it

1. Take Dielectric plate (1) and install Vibrator (2) on the plate. Use clamps or hard wire for this.

145 MHz the vibrator takes the length 1270-mm at the diameter of the vibrator 4…5-mm, and 1200 m at the diameter of the vibrator 10…14-mm.

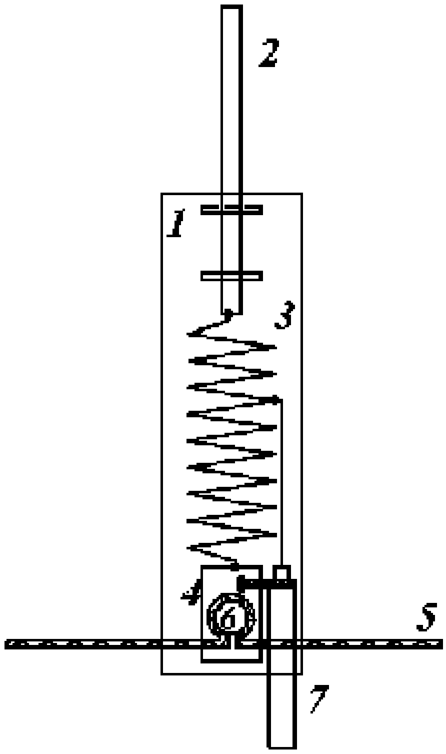
2. Install Tinned plate (4) on the Dielectric plate. Use Stud, washers, screw - nuts (6).

3. Do Matching spool (3). The spool has 9 turns of 1.5…2.5-mm diameter (# 14- 10 AWG) copper or silvered plate wire. ID of the spool is 15…18-mm, RA1TW use to old markers as a form for the spools. Length of the spool is 34-mm.

4. Install the Matching spool on the Dielectric plate. For doing this, the upper end of the spool is fixed to the Vibrator and the down end of the spool is fixed to the Tinned plate. Use solder or fix the ends with the help of screws.

5. Do counterpoises. Two 105-cm lengths of copper or aluminum wire of 4…6-mm (# 2…6 AWG) are bended as a Greek letter OMEGA looks (see **Figure 2**).

Bottle Antenna
Side view



Top view

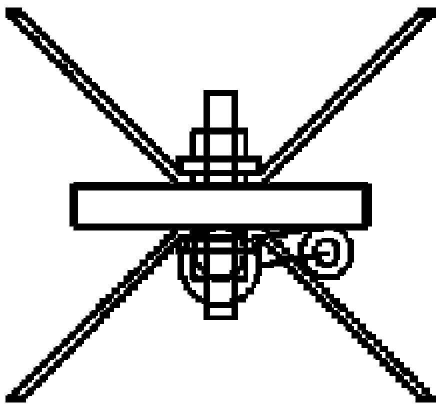


Figure 1

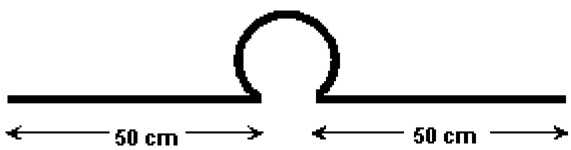


Figure 2. Counterpoises

6. Fix the OMEGA- counterpoises to the Stud with the help of the Screw-nuts. The counterpoises should be at 90 degree to the Vibrator and to each other.

7. Fix the OMEGA- counterpoises to the Stud with the help of the Screw-nuts. The counterpoises should be at 90 degree to the Vibrator and to each other.

8. Install Coax (7). Central core is soldered to 3-1/3 tap from the Vibrator, the braid is soldered to the Tinned plate (4).

9. Take a Bottle from dry drink. (I know, RA1TW always prefers a bottle from beer!. I.G.) Do a hole in the screw - top of the Bottle, cut the bottom of the Bottle, cut four slots for counterpoises, and then, install the Bottle (see photo) on the Antenna.

That is all the Bottle Antenna is ready!

Tuning:

The best way to adjust the Bottle Antenna is to use Meter of Amplitude vs Frequency Response characteristics. The device is switched to the Bottle Antenna and we see the frequency characteristic of the antenna. Stretch out the Matching spool or cut lengths of the Vibrator and Counterpoises if the resonance frequency of the antenna is below then 145 MHz. Gripe the Matching spool if the resonance frequency of the antenna is higher then 145 MHz Then select the tap for the best SWR. It is possible to match with the antenna a coaxial cable with any characteristic impedance –50 or 75 Ohms.

RA1TW

Of course, you can adjust the antenna with the help of only SWR – meter or VHF - bridge.There are 8 such home - made Bottle Antennas at Novgorod. All antennas work very well. They provide good communication as inside city as from city to a country for a distance more of 100 kilometers.

Credit line: http://hamnv.boom.ru

5/8 λ VHF- UHF Antenna

Alex, RA3GBQ, hamradio.lipetsk.ru, natan@lipetsk.ru

To do the antenna one can very easy as well as the costs are nothing. You need a box of a sweets- surprise Chupa- Chups, a piece of an old coax, some wire, epoxies, and a little of job.

So, go to do it!

►Take glass-reinforced plastic rod 5 and upper part of a sweets- surprise Chupa- Chups 10.
Insert the rod and wire 4 for matching coil into item 10.

►Take a metal tube, cut a ring 7 and insert into item 10.

►Take a plastic cap 8 from a plastic can, fix a RF- socket 9 on it, solder the wire of the coil 4 to the socket , solder by 3-5 wire the ring 7 to the socket.

►Turn up item 10, fill up it by epoxies 6, and close it by the cap 8.

►When the epoxies are hardened, drill holes for counterpoises 11 at low side of the item 10 and through out item 7.

►Cut a thread into item 5 and onto counterpoises 11.

►Remove braid 3 from a coaxial cable, put on the braid 3 onto item 5 that before is covered a glue. The length of the braid 3 is equal to 5/8λ for 144 0r 430 MHz.

►Coil the spool 4 (any number of turns) with step between turns of 1-mm, solder the spool to the braid 3.

►Insert 6 λ/4 counterpoises.

►Meter SWR. Chose a tap from the coil 3 to minimum SWR.

►Put on a can of a pen onto the upper end of the rod 5.

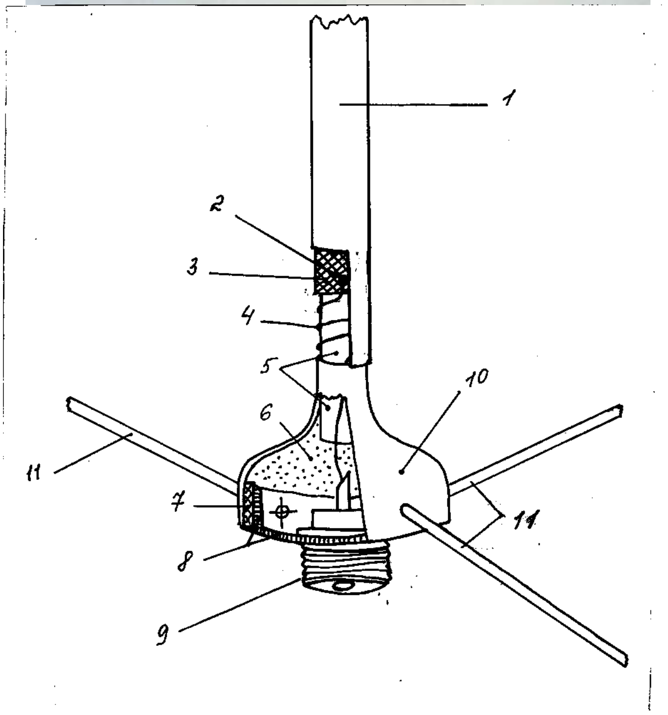
►Put on a shrink plastic tube 1 onto the rod 5.

►Heat the shrink plastic tube.

Get you own antenna!

73!

Sweets- surprise Chupa- Chups



http://www.antentop.bel.ru/

SHORT 'RUBBER DUCK' FOR VHF/UHF HAND - HELD

Igor, UA6HJG, ua6hjg@mail.ru

All portable hand – held radios have a short “rubber duck” antenna. Some of the rubber duck antennas are rather long and if it is not necessary to communicate on a far distance, the long antenna just hinders to use a hand- held. I decided to make a short rubber duck antenna that is convenient for daily usage and for short distance communication.

Range 144 - 146 МГц

... For Yaesu VX-1R and C - 508

I have made this antenna for **VX-1R** as it has a small RF-socket SMA. Antenna has length in 43-mm (together with RF-socket). Copper wire of diameter 0.6-mm (# 23 AWG) is coiled up a turn- to turn on a form of diameter of 8-mm. 25.5 turns were coiled. At thus the resonance of the antenna was at 145.3-MHz with SWR 1:1. After winding and checks of the resonance, put on a shrink plastic tube on the antenna, and heat it.

For any stations having BNC socket

Antenna has length in 69-mm (together with RF-socket). Copper wire of diameter 1.3-mm (# 16 AWG) is coiled up a turn- to turn on a form of diameter of 10-mm. 22 turns were coiled. At thus the resonance of the antenna was at 145.3-MHz with SWR 1:1. After winding and checks of the resonance, put on a shrink plastic tube on the antenna, and heat it.

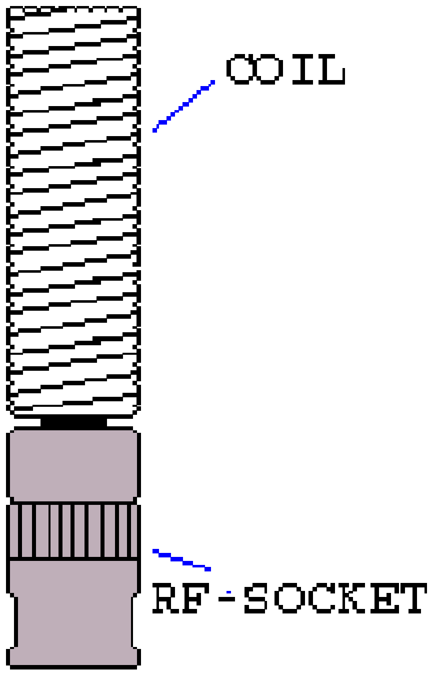
Range 430 - 440 МГц

The design of an antenna for a range of 433-MHz does not differ from the previous design, only it need to reduce the number of turns of the coil. Antenna has length in 42-mm (together with RF-socket). Copper wire of diameter 1.3-mm (# 16 AWG) is coiled up a turn- to turn on a form of diameter of 8.5-mm. 6 turns were coiled. At thus the resonance of the antenna was at 435.3-MHz with SWR 1.8:1. After winding and checks of the resonance, put on a shrink plastic tube on the antenna, and heat it.

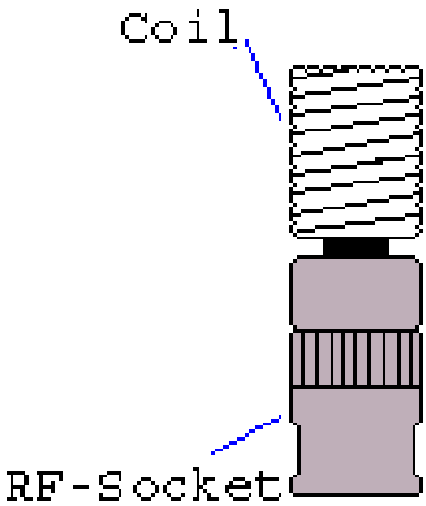
These designs were checked with hand-held radios VX-1R, C-568, FT-50 and C-508. At range of communication in city 1-2-kms the home- brew rubber duck almost do not lose to commercial – made ones.

73!

145 MHz ‘Rubber Duck’



430 MHz ‘Rubber Duck’



Credit Line: http://www.cqham.ru/

Twins Delta Loop for 145 MHz

by ***Nick V. Derenko**, **US8AR***

UKRAINE

US8AR

ex UB5AEO, UB4AR *mailto:us8ar@qsl.net*
http://www.qsl.net/us8ar
http://us8ar.narod.ru

SOMEWORDS ABOUTE MYSELF

Hello ! If it's interesting I'll tell some aboute myself. I was born 25 may 1957 y. in Snesznoe town of Donetsk obl. of Ukraine. After finishing Primorsko-Akhtarsk's school in 1974 I worked a locksmith and a turner. In 1975 I entered in Taganrog radiotechnical institute and finished it in 1980. After it I living and working in Romny town of Sumy oblast of Ukraine. I worked an engineer in Romny's branch of Leningrad NPO "Krasnaja Zaria" and seniorengineer in Special Design Bureau "Poisk". Since 1997 I working a foreman of powerenergetics of "Akhtyrkaneftegaz". I am married and have daughter and son.

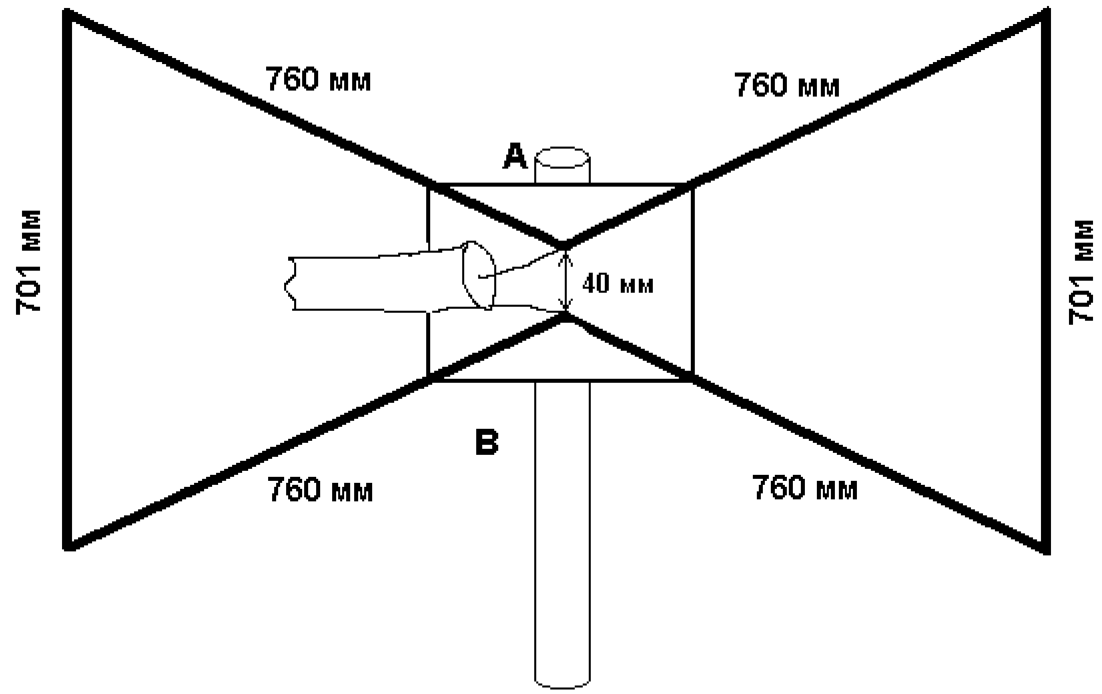
Specification:

- Directional diagram: "Eight" with low-altitude beam to horizon;

- Input resistance: 50 Ohm;
- ***Polarization -*** Vertical;
- Gain 6 dB;
- SWR 1,01:1.

Figure 1 shows the antenna.

Figure 1



The antenna is made from a copper or aluminum wire in diameter of 4 mm. A copper or brass tube also will do well. The wires fastened by collars to a dielectric plate in 4 mm thickness. I use a plate from PC stuff. The plate fastened by collars to the antenna metal mast.

A coaxial cable is connected to points "A" and "B" (the central core to "A", the braid to "B").

Below, there is a file of the antenna in **MMANA**.

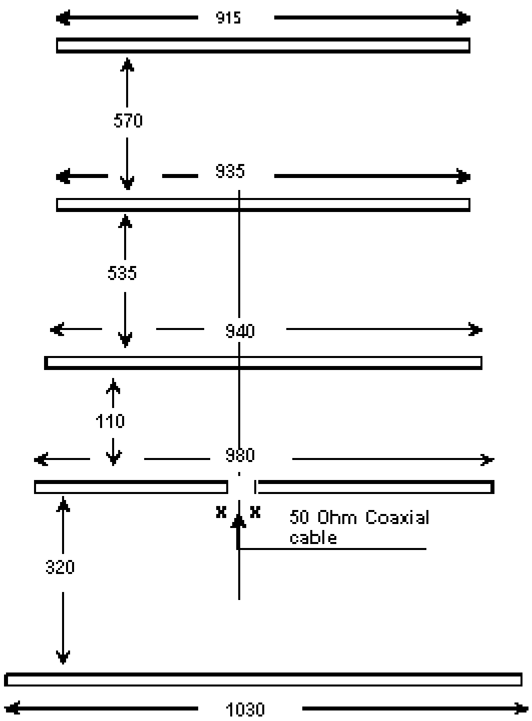
(MMANA available FREE at www.qsl.net)

The great collection Antenna Files at:
http://www.qsl.net/dl2kq/mmana

```
Twins Delta For  145_50 MHz
*
145.5
* wire *
7
0.0,    0.6845,  -0.3505, 0.0,    0.6845,  0.3505,  0.002,     -1
0.0,    0.6845,  -0.3505, 0.0,    0.0,     -0.02,   0.002,     -1
0.0,    0.6845,  0.3505,  0.0,    0.0,     0.02,    0.002,     -1
0.0,    0.0,     -0.02,   0.0,    -0.6845, -0.3505, 0.002,     -1
0.0,    0.0,     0.02,    0.0,    -0.6845, 0.3505,  0.002,     -1
0.0,    -0.6845, -0.3505, 0.0,    -0.6845, 0.3505,  0.002,     -1
0.0,    0.0,     -0.02,   0.0,    0.0,     0.02,    8.000e-04,     -1
*** sources ***
1,      1
w7c,    0.0,     1.0
*** load ***
0,      1
*** Autosegment ***
400,    40,      2.0,     1
*G/H/M/R/AzEl/X*
0,      5.0,     0,       50.0,   0,       0,       0
```

Enjoy!

Five Elements VHF Antenna RN1NZ For 145 MHz



Gain: 8.5 dBi

SWR: Less then 1.5:1 at 144...146 MHz

Front/Back Ratio: more then 18 dB

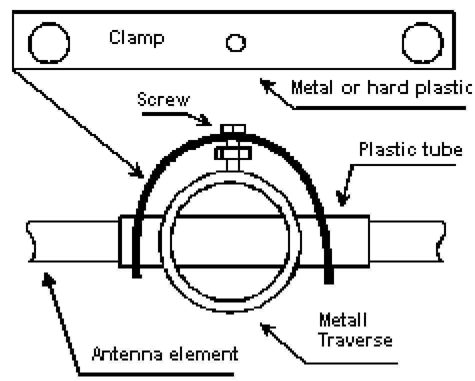
Input Impedance: 50 Ohm

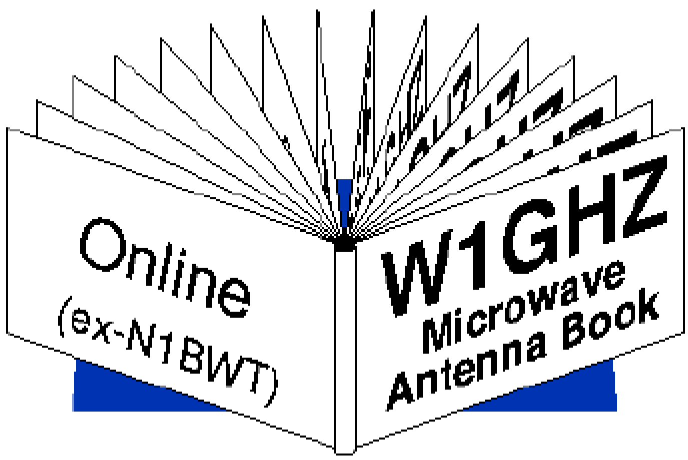
All elements have diameter of 4-mm (or #6 AWG)

Traverse has diameter of 15-mm and lenfth of 1600-m

Antenna elements are electrically insulated from the traverse

Antenna Construction





RN1NZ
rn1nz@onego.ru

Credit Line: RN1NZ @ Radio #4, 2002, p.65
For more info see:
www.radio.ru/

РАДИО

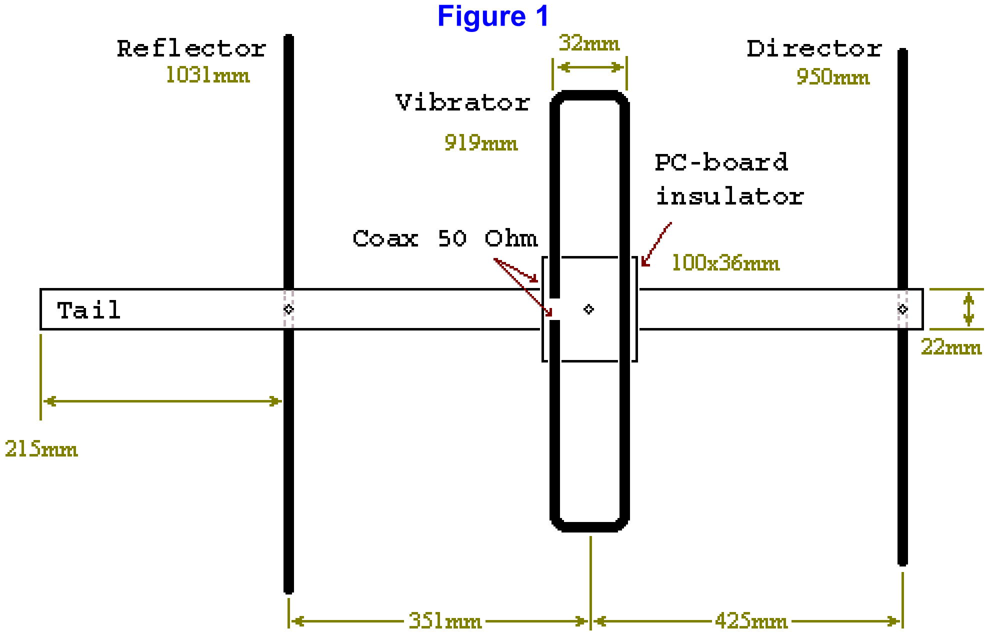
FOLDING 3-EL YAGI FOR MOUNTAINS

Igor, UA6HJG, ua6hjg@mail.ru

This antenna was developed specially for mountains trip from my experience of radio communication in mountains. The antenna is optimized to the maxima forward gain. At work you can hold the antenna by the "tail" and direct the antenna to your correspondent using vertical or horizontal polarization.

Figure 1 shows the design of the antenna. Antenna boom is made of a plastic water pipe of 1000-mm of length and of 22-mm OD. Antenna reflector and vibrator both are made of aluminum wire of 5-mm of diameter. Antenna vibrator is made of bimetallic wire of 5-mm of diameter. The vibrator is soldered to PC –board that is the central insulator for the vibrator.

Figure 1



A 50-Ohms coaxial cable is used with the antenna without any symmetrical devices. The cable goes along the boom and get out from the tail. For antenna folding you can loose screws, turn antenna vibrator along the boom, and again strength the screws. Antenna director and reflector is removed from the boom and hide inside the boom.

Coaxial cable has the length of 1100-mm. The cable is laid inside the boom and get out from the tail. It is need to protect from weather the place where the coaxial cable is soldered to the vibrator. RF socket also must be protected from weather and dirty at transportation of the antenna. Antenna has weight of 0.4-KG. Practical measured (by device SWR-121) SWR is: at 144.7=1.3:1, 145.2=1:1, 145.7=1.6:1.

Antenna has gain compare to half-wave dipole 6-7 dB. In general to measure the real gain of an antenna in the amateur conditions is practically not easy matter. I use a comparative method that shows advantage one antenna above other one. The essence of this method is simple. You take a dipole as the exemplary antenna and do compare the dipole with the experimental antenna.

Being on the southern slope of Elbrus- mountain at height of 4000 meters I use the method with help of Turkish ham station TA7T. The distance between me and TA7T was approximately 500-kms. I hardly heard TA7T by my exemplary dipole but I had 59 with the YAGI. It is near 10 dB in real gain!

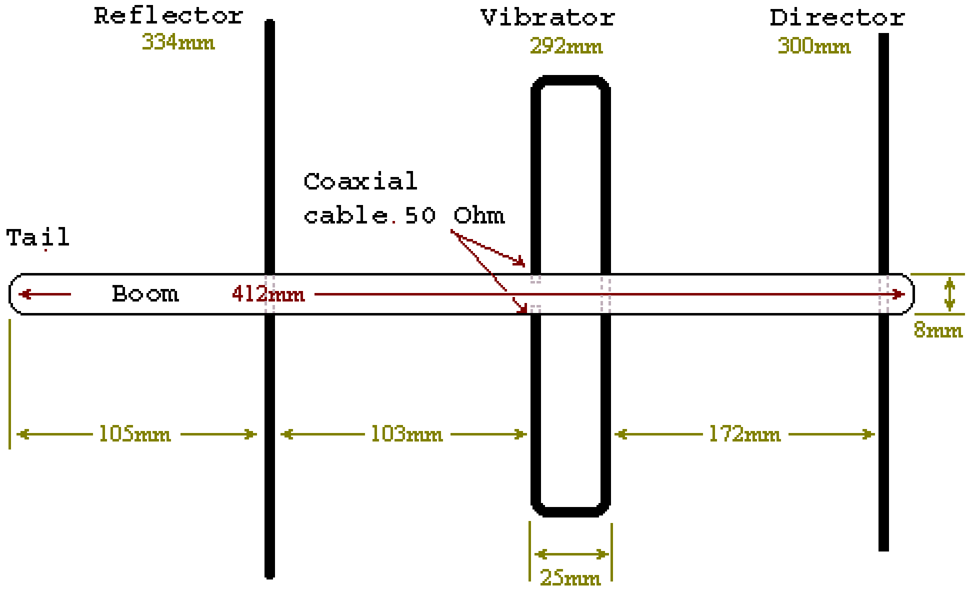
Simple 430-MHz 3-el YAGI for Mountains

Igor, UA6HJG, ua6hjg@mail.ru

I want to pay attention that UHF antennas for mountain climbing has the own specificity. So, antennas having the gain more the 6-9-Db-dB are not necessary in mountains at big height (from 3000 meters and is higher), as well as you do not need mast for the antennas. Also I prefer not knock- down antenna design. .

This antenna was developed specially for high-mountainous trip proceeding from my previous experience. At the first place I stand following characteristics: gain, weight, reliability. The antenna is optimized of the maxima forward gain. The design is made not knock- down that is

Figure 1



very conveniently as the antenna is always ready to operation. You can hold the antenna by its tail and direct the antenna to your correspondent at operation.

Figure 1 shows the design of the antenna. The boom is made of an ebonite rod of 412-mm length and of 8-mm diameter. Antenna elements are made of a copper wire of 2- mm (#12 AWG) diameter. 50 Ohms coaxial cable is soldered to antenna vibrator without any symmetrical and matching devices. The coaxial cable goes along the boom and get out from the antenna tail. Antenna elements are fastened to the boom by epoxies. The antenna can place above or inside a tourist backpack.

The coaxial cable has length of 50-mm. The place of the soldering of the coaxial cable to the vibrator must be protected from the weather. Antenna has weight of 150 gram. 150rp, real gain of 6-7 dB above half-wave dipole. SWR is: at 433-MHz =1.8:1, at 435-MHz =1.4:1, at 438-MHz=1:1, at 440-MHz=1.5:1 (it as measured by device 'SWR-121').

Commentary:
I recommend to use the antenna with low-power UHF radio (10-mWtts) for a range 433-434Mгц. I have 30- 50 kms of distance (at direct vision) using the antenna with such station. Also I recommend to use the antenna with usual UHF radios, be sure, you easy will skip more than 100-kms!

Credit Line: http://www.mountain.ru

SIMPLE 430-MHZ 4-EL YAGI FOR MOUNTAINS

Igor, UA6HJG, ua6hjg@mail.ru

The purpose of this design is to create an antenna for mountains. The antenna must correspond follow requirements:

1. To have gain not less the 7-dB. Forward Gain is the main characteristic of the antenna.
2. A wide lobe must be. During a QSO you can hold the antenna by the tail and shaking of the antenna should not result to full 'failure' of the communication.
3. Simplicity in making and adjustments. An opportunity of fast repair in field conditions.
4. Antenna weight with coaxial cable both must be up to 500 gram.
5. 50-Ohm coax for the feeding must be used.

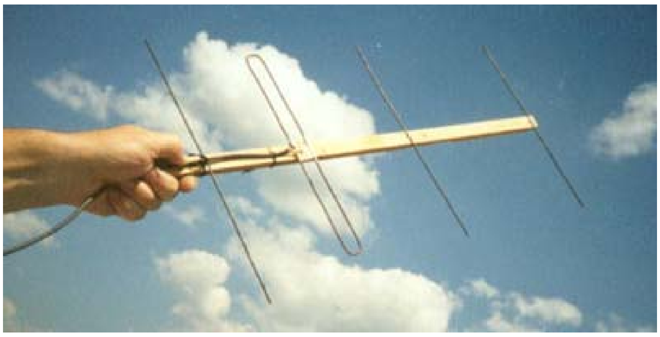
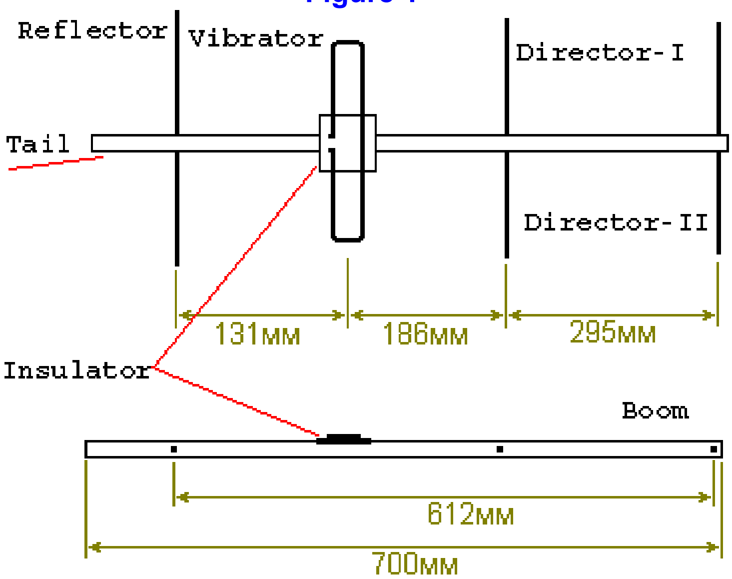


Figure 1 shows a design of such antenna. The boom is made of a wooden strip.. Elements and the vibrator are made of 2-mm copper wire (# 12 AWG).

The sizes of elements:
Reflector 345-mm.
Vibrator 285-mm.
Director-I 312-mm.
Director-II 306-mm.

Figure 1

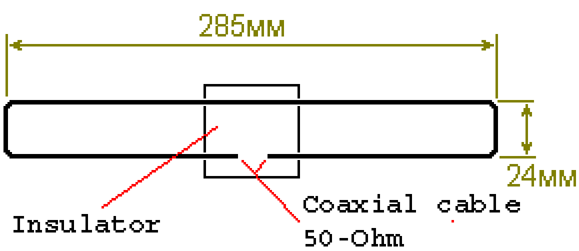


The design of antenna vibrator is shown on **Figure 2**. Coaxial cable has 850-mm length and this one goes along the boom. Soldered place must be protected from weather.

Antenna has weight of 290 gram. SWR (metered by SWR-291) is: at 433- MHz =2:1, at 435-MHz =1:1, at 438-MHz =2:1.

The antenna worked very well in the mountains. Also the antenna may be used for stationary work from a fixed QTH.

Figure 2

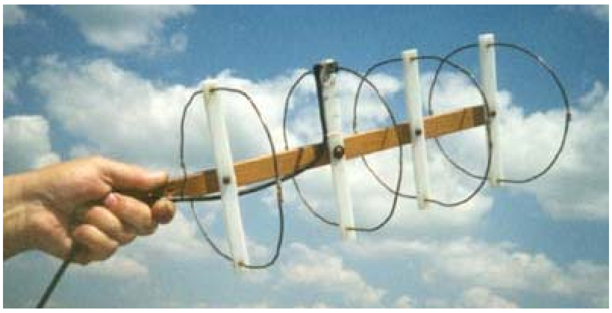


Credit Line: http://www.mountain.ru

4-Ovals Antenna for 430-440 MHz

Igor, UA6HJG, ua6hjg@mail.ru

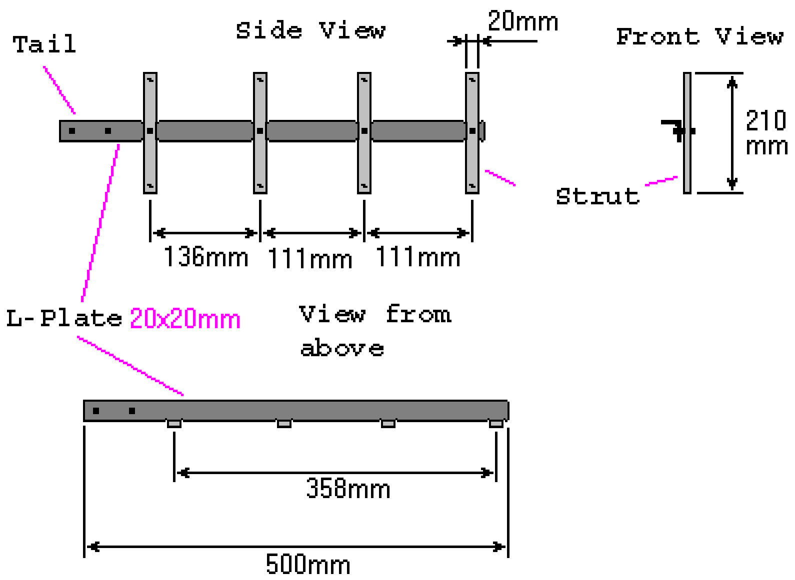
I need a good universal antenna for repeaters working at the 70-cm range, packet radio and for routine work. Such antenna must be satisfy the follow characteristics:



1. Real Gain 9-10-dB.
2. Low SWR at 430-440- MHz.
3. Wide forward lobel.
4. Unpretentiousness to close located subjects.
5. Simplicity in manufacturing and adjustments.
6. Possibility to create phased антенные systems on the basis of the antennas.
7. 50 - Ohm coaxial cable feeding.
8. Stability to heavy icing and to winds in 10-20 meters per second..

4 Ovals Antenna responded all of the conditions. Why an oval? At first, from the antenna theory we know that an oval radiates energy a little bit more effectively than a square. At the second, in practical, it is more easy to do an oval then a square.. So choose the OVAL! **Figure 1** shows a design of the

Figure 1



antenna. Boom is made of iron L-plate 25x25-mm. All the four ovals are fastened to the boom by struts made of insulation stuff such as tree, hetinax, etc. Antenna is fastened by the tail, that is behind the struts.

Perimeter of elements (ovals):

Reflector- 727-mm. *(-20-mm for soldering)*.

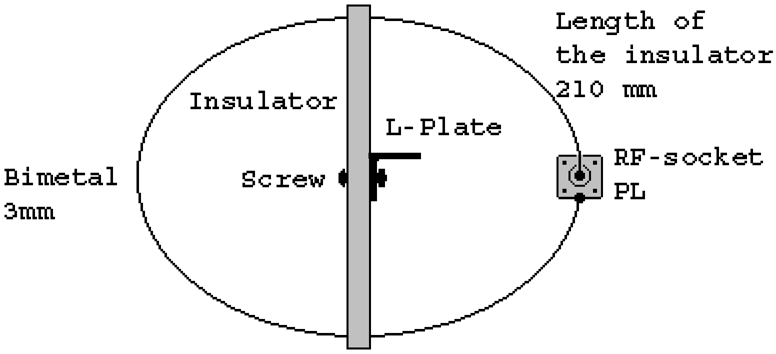
Driven Element- 653-mm *(+10-mm distance for a RF socket)*.

Director-I- 649-mm. *(-20мм)*.

Director- II - 639-mm. *(-20-mm)*.

Figure 2 shows the design of the Driven Element. RF socket is soldered directly by the ends of the oval. Three holes is drilled at each strut. One holes is in the center for fastened the strut to the boom, two holes are at the ends for bimetal oval. Antenna reflectors and directors have the same design as the Driven Element only difference is its ends soldered together.

Figure 2



Antenna has weight of 900 gram. SWR is: at 430-MHz =1.2:1, at 435-MHz =1:1, at 440-MHz=1.3:1 SWR was metered by device SWR-121. If you will use boom made of iron L-plate having not the same dimensions you would do correction lengths of antenna elements. I want to pay attention, that the antenna is more laborious than YAGI, but it work much better.

4-Ovals Antenna for 430-440 MHz for Mountains

Igor, UA6HJG, ua6hjg@mail.ru

When an antenna is intended for mountains it must follow such additional requirements as:

1. Light weight.
2. To have folding design and to take a little place in a backpack.
3. Antenna should be conveniently to hold in a hand, to fasten to a tree or stick. .
4. Tolerance to a dirty, water and snow.
5. Possibility to repair in field conditions.
6.

So, the boom of the trip antenna is made of a wooden strip drying by oil. Perimeter of all ovals is increased on 20-mm compare to previous design. All struts are made from un- foiled PC-board. Antenna elements are made of 2-mm diameter soft copper wire (# 12 AWG). Soldered parts must be protected from the weather.

Antenna has weight 400 gram. Other characteristics are as the previous design has. The antenna is tested at 1997 and at 2000 in the mountain Elbrus and the antenna shows good result. I made QSOs in distance of 200-300 kms with 59 for both ends!

Igor, UA6HJG, on Elbrus

Elbrus