ANTENTOP

ANTENTOP 01 2007 # 009

ANTENTOP is *FREE* e-magazine devoted to ANTENna's Theory, Operation, and Practice

1-2007

Edited by hams for hams

In the Issue:
Antennas Theory!

Practical design of HF-VHF- UHF Antennas!

Home brew Technique!

Propagation!

QRP!

And More….

EW1LN 433-MHz Quad

UR5WCA Antenna

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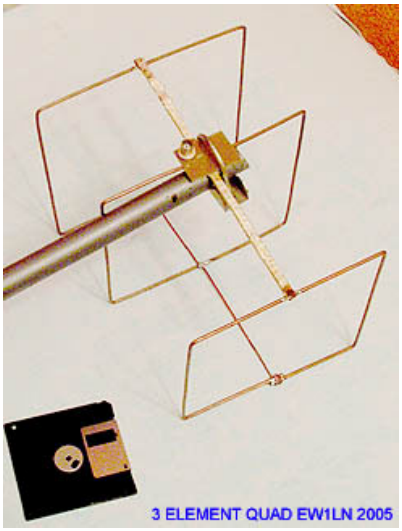

EDITORIAL:

Well, my friends, new ANTENTOP – 01 -2007 come in! ANTENTOP is just authors' opinions in the world of amateur radio. I do not correct and re-edit yours articles, the articles are printed "as are". A little note, I am not a native English, so, of course, there are some sentence and grammatical mistakes there… Please, be indulgent!

ANTENTOP 01 –2007 contains antenna articles, and several historical articles. Hope, it will be interesting for you.

Our pages are opened for all amateurs, so, you are welcome always, both as a reader as a writer.

73! Igor Grigorov, VA3ZNW

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Welcome to ANTENTOP, FREE e - magazine!

ANTENTOP is ***FREE e- magazine***, made in **PDF**, devoted to antennas and amateur radio. Everyone may share his experience with others hams on the pages. Your opinions and articles are published without any changes, as I know, every your word has the mean.

Every issue of ANTENTOP is going to have 100 pages and this one will be paste in whole on the site. Preview's files will be removed in this case. I do not know what a term for one issue will need, may be 8-10 month or so. A whole issue of ANTENTOP hold nearly 10 MB.

A little note, I am not a native English, so, of course, there are some sentence and grammatical mistakes there… Please, be indulgent!

Preview: Some articles from "cooking" issue will be pasted for preview on this site, others no. Because, as I think, it must be something mysterious in every issue.

Publishing: If you have something for share with your friends, and if you want to do it ***FREE***, just send me an email. Also, if you want to offer for publishing any stuff from your website, you are welcome!

Your opinion is important for me, so, contact if you want to say something!

Copyright Note:

Dear friends, please, note, I respect Copyright. Always, when I want to use some stuff for ANTENTOP, I ask owners about it. But… sometimes my efforts are failed. I have some very interesting stuff from closed websites, but I can not go to touch with their owners… as well as I have no response on some my emails from some owners.

I have a big collection of pictures, I have got the pictures and stuff in others ways, from ***FREE websites***, from commercial CDs, intended for ***FREE using***, and so on... I use to the pictures (and seldom, some stuff from closed websites) in ANTENTOP. ***If the owners still are alive***, please, contact with me, I immediately remove any Copyright stuff, or, if it is necessary, all needed references will be made there.

I do not know, why the owners do not response me. Are they still alive? Do their companies are a bankrupt? Or do they move anywhere? Where they are in the end?

Business Advertising: ANTENTOP is not a commercial magazine. Authors and I (Igor Grigorov, the editor of the magazine) do not get any profit from the issue. But off course, I do not mention from commercial ads in ANTENTOP. It allows me to do the magazine in most great way, allows me to pay some money for authors to compensate their hard work. I have lots interesting stuff in Russian, and owners of the stuff agree to publish the stuff in ANTENTOP… but I have no enough time to translate the interesting stuff in English, however I may pay money to translators,

and, they will do this work, and we will see lots interesting articles there.
So, if you want to put a commercial advertisement in ANTENTOP, please contact with me. A commercial advertisement will do ANTENTOP even greater interesting and various! I hope, readers do not mention against such commercial ads.
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73! ***Igor Grigorov***, VA3ZNW

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Polarization and Related Antenna Parameters

Feel Yourself a Student!

Dear friends, I would like to give to you an interesting and reliable antenna theory. Hours searching in the web gave me lots theoretical information about antennas. Really, at first I did not know what information to chose for ANTENTOP. Finally, I stopped on lectures "Modern Antennas in Wireless Telecommunications" written by Prof. Natalia K. Nikolova from McMaster University, Hamilton, Canada.

You ask me: Why?

Well, I have read many textbooks on Antennas, both, as in Russian as in English. So, I have the possibility to compare different textbook, and I think, that the lectures give knowledge in antenna field in great way. Here first lecture "Introduction into Antenna Study" is here. Next issues of ANTENTOP will contain some other lectures.

So, feel yourself a student! Go to Antenna Studies!

I.G.

My Friends, the above placed Intro was given at ANTENTOP- 01- 2003 to Antennas Lectures.

Now I know, that the Lecture is one of popular topics of ANTENTOP. Every Antenna Lecture was downloaded more than 1000 times!

Now I want to present to you one more very interesting Lecture - it is a Lecture* Polarization and Related Antenna Parameters*. I believe, you cannot find such info anywhere for free! Very interesting and very useful info for every ham, for every radio- engineer.

So, feel yourself a student! Go to Antenna Studies!

I.G.

McMaster University Hall

Prof. Natalia K. Nikolova

Polarization and Related Antenna Parameters

Polarization of EM fields – revision. Polarization vector. Antenna polarization. Polarization loss factor and polarization efficiency.

by Prof. Natalia K. Nikolova

Lecture 5: Polarization and Related Antenna Parameters

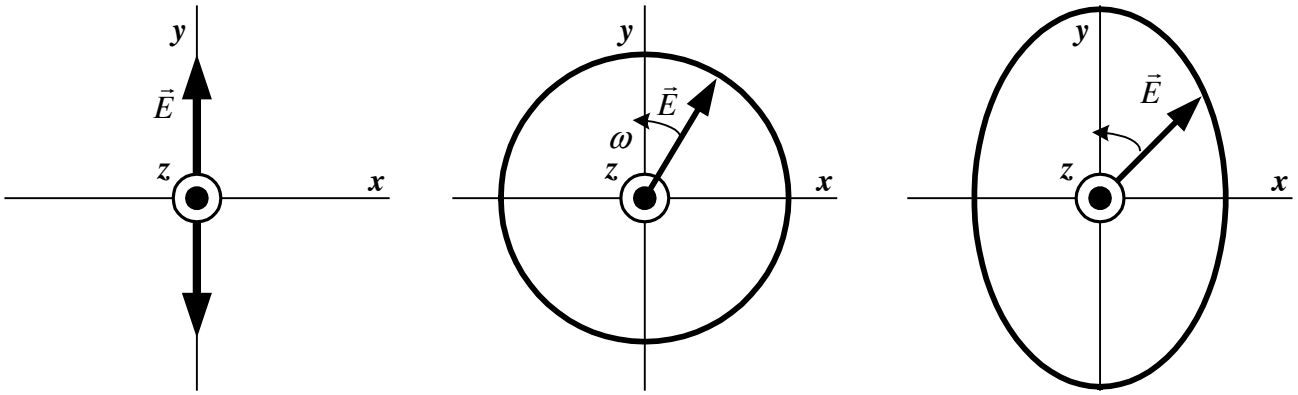
(*Polarization of EM fields – revision. Polarization vector. Antenna polarization. Polarization loss factor and polarization efficiency.*)

1. Polarization of EM fields.

The polarization of the EM field describes the time variations of the field vectors at a given point. In other words, it describes the way the direction and magnitude the field vectors (usually $\vec{E}$) change in time.

> The ***polarization*** is the figure traced by the extremity of the time-varying field vector at a given point.

According to the shape of the trace, three types of polarization exist for harmonic fields: ***linear***, ***circular*** and ***elliptical***:



(a) linear polarization (b) circular polarization (c) elliptical polarization

Any type of polarization can be represented by two orthogonal linear polarizations, $(\tilde{E}_x, \tilde{E}_y)$ or $(\tilde{E}_H, \tilde{E}_V)$, whose fields are out of phase by an angle of δ_L.

- If $\delta_L = 0$ or $n\pi$, then a linear polarization results.
- If $\delta_L = \pi/2$ (90°) and $E_x = E_y$, then a circular polarization results.
- In the most general case, elliptical polarization is defined.

It is also true that any type of polarization can be represented by a right-hand circular and a left-hand circular polarizations ($\tilde{E}_L, \tilde{E}_R$).

We shall revise the above statements and definitions, while introducing the new concept of polarization vector.

2. Field polarization in terms of two orthogonal linearly polarized components.

The polarization of any field can be represented by a suitable set of two orthogonal linearly polarized fields. Assume that locally a far field propagates along the *z*-axis, and the field vectors have only transverse components. Then, the set of two orthogonal linearly polarized fields along the *x*-axis and along the *y*-axis, is sufficient to represent any TEM_z field. We shall use this arrangement to demonstrate the idea of polarization vector.

The field (time-dependent vector or phasor vector) is decomposed into two orthogonal components:

$$\vec{e} = \vec{e}_x + \vec{e}_y \quad \Rightarrow \quad \vec{E} = \vec{E}_x + \vec{E}_y, \tag{5.1}$$

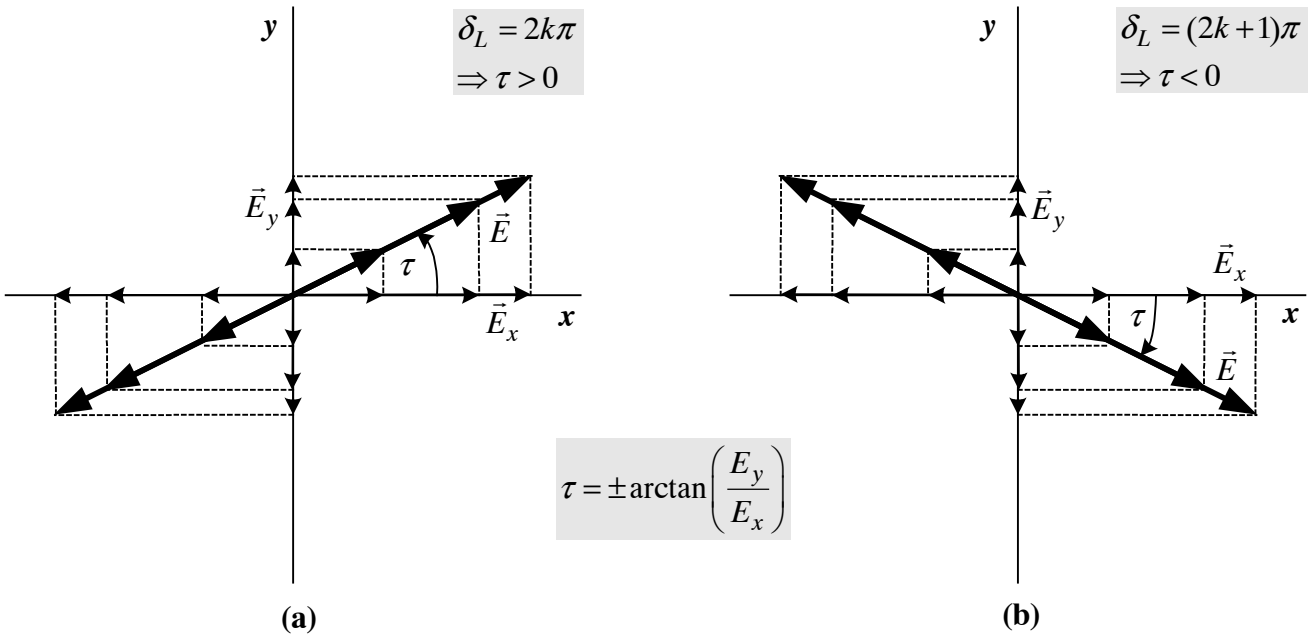
$$\begin{aligned} \vec{e}_x &= E_x \cos(\omega t - \beta z)\hat{x} \\ \vec{e}_y &= E_y \cos(\omega t - \beta z + \delta_L)\hat{y} \end{aligned} \quad \Rightarrow \quad \begin{aligned} \vec{E}_x &= E_x \hat{x} \\ \vec{E}_y &= E_y e^{j\delta_L}\hat{y} \end{aligned} \tag{5.2}$$

At a fixed position (assume $z = 0$), equation (5.1) can be written as:

$$\begin{aligned} &\vec{e}(t) = \hat{x} \cdot E_x \cos\omega t + \hat{y} \cdot E_y \cos(\omega t + \delta_L) \\ &\Rightarrow \boxed{\vec{E} = \hat{x} \cdot E_x + \hat{y} \cdot E_y e^{j\delta_L}} \end{aligned} \tag{5.3}$$

Case 1: Linear polarization: $\delta_L = n\pi, \quad n = 0,1,2,\ldots$

$$\begin{aligned} &\vec{e}(t) = \hat{x} \cdot E_x \cos(\omega t) + \hat{y} \cdot E_y \cos(\omega t \pm n\pi) \\ &\Rightarrow \boxed{\vec{E} = \hat{x} \cdot E_x \pm \hat{y} \cdot E_y} \end{aligned} \tag{5.4}$$



Case 2: Circular polarization:

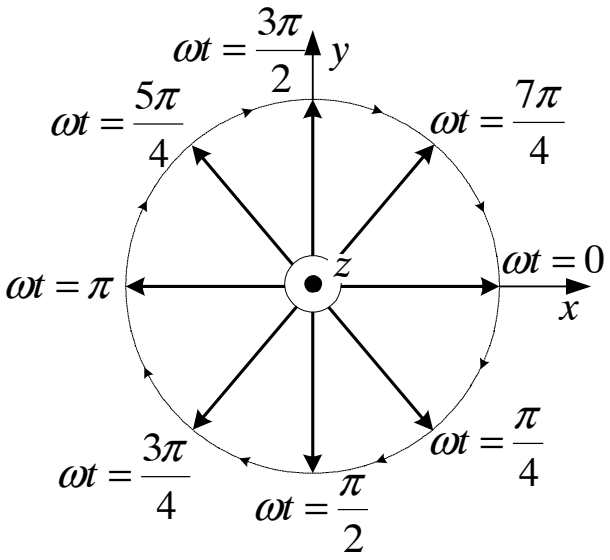
$$E_x = E_y = E_m \quad \text{and} \quad \delta_L = \pm\left(\frac{\pi}{2} + n\pi\right), \quad n = 0,1,2,\ldots$$

$$\vec{e}(t) = \hat{x} \cdot E_x \cos(\omega t) + \hat{y} \cdot E_y \cos[\omega t \pm (\pi/2 + n\pi)]$$

$$\Rightarrow \boxed{\vec{E} = E_m(\hat{x} \pm \hat{y} \cdot j)} \qquad (5.5)$$

$$\vec{E} = E_m(\hat{x} + j\hat{y})$$

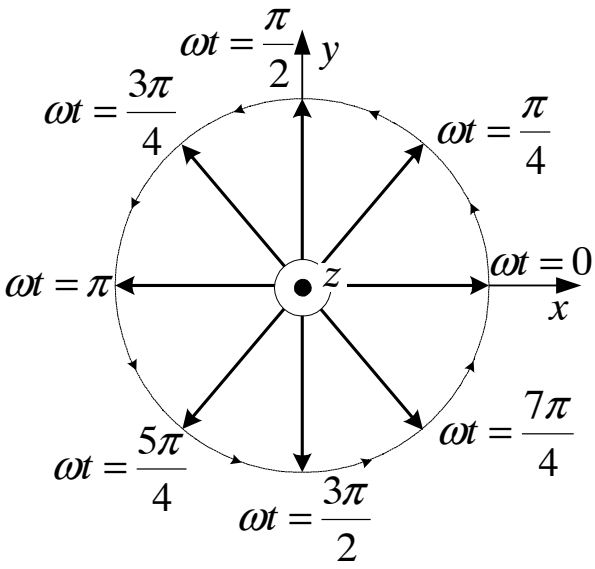
$$\delta_L = +\frac{\pi}{2} + 2n\pi$$



If $(-\hat{z})$ is the direction of propagation: ***clockwise (CW)*** or ***right-hand*** polarization

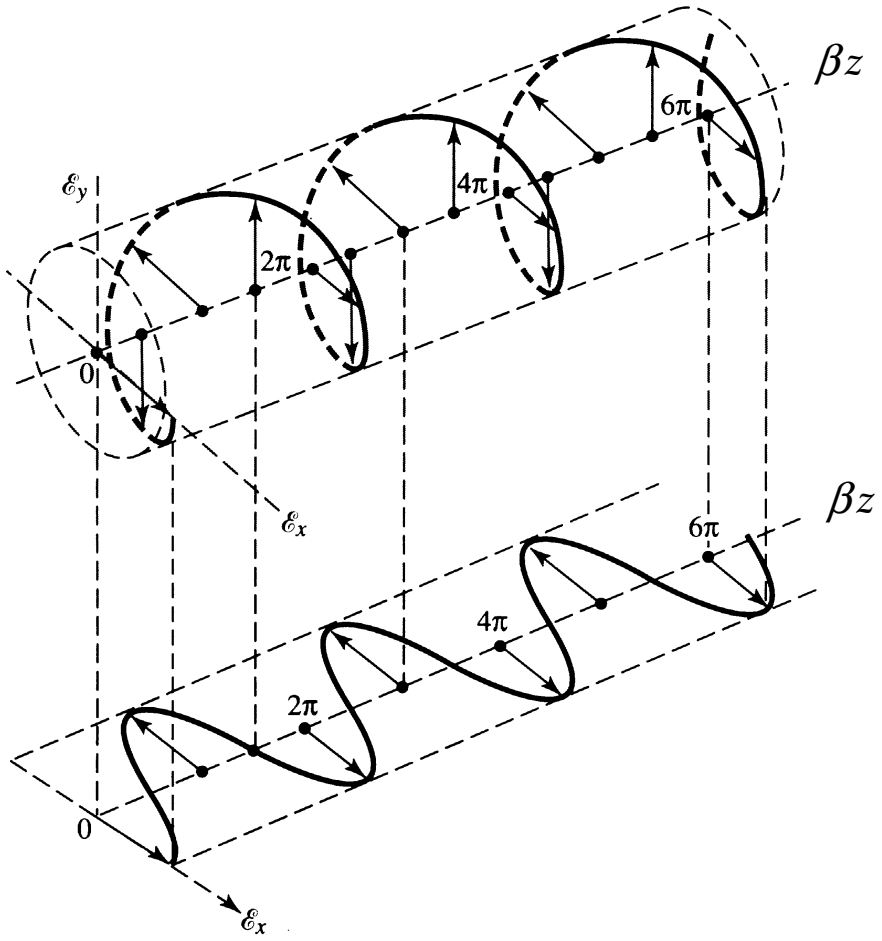
$$\vec{E} = E_m(\hat{x} - j\hat{y})$$

$$\delta_L = -\frac{\pi}{2} - 2n\pi$$



If $(-\hat{z})$ is the direction of propagation: ***counterclockwise (CCW)*** or ***left-hand*** polarization

A picture of the field vector (at a particular moment of time) along the direction of propagation (left-hand circularly polarized wave):



Case 3: Elliptical polarization

The field vector at a given point traces an ellipse as a function of time. This is the most general type of polarization of time-harmonic fields, obtained for any phase difference δ and any ratio (E_x / E_y). Mathematically, the linear and the circular polarizations are special cases of the elliptical polarization. In practice, however, the term *elliptical polarization* is used to indicate polarizations *other than linear or circular*.

$$\begin{aligned} &\vec{e}(t) = \hat{x} \cdot E_x \cos \omega t + \hat{y} \cdot E_y \cos(\omega t + \delta_L) \\ &\Rightarrow \vec{E} = \hat{x} \cdot E_x + \hat{y} \cdot E_y e^{j\delta_L} \end{aligned} \tag{5.6}$$

Show that the trace of the time-dependent vector is an ellipse:

$$e_y(t) = E_y(\cos \omega t \cdot \cos \delta_L - \sin \omega t \cdot \sin \delta_L)$$

$$\cos \omega t = \frac{e_x(t)}{E_x} \text{ and } \sin \omega t = \sqrt{1 - \left(\frac{e_x(t)}{E_x} \right)^2}$$

$$\sin^2 \delta_L = \left[\frac{e_x(t)}{E_x} \right]^2 - 2 \left[\frac{e_x(t)}{E_x} \right] \left[\frac{e_y(t)}{E_y} \right] \cos \delta_L + \left[\frac{e_y(t)}{E_y} \right]^2$$

or

$$1 = x^2(t) - 2x(t)y(t)\cos \delta_L + y^2(t), \tag{5.7}$$

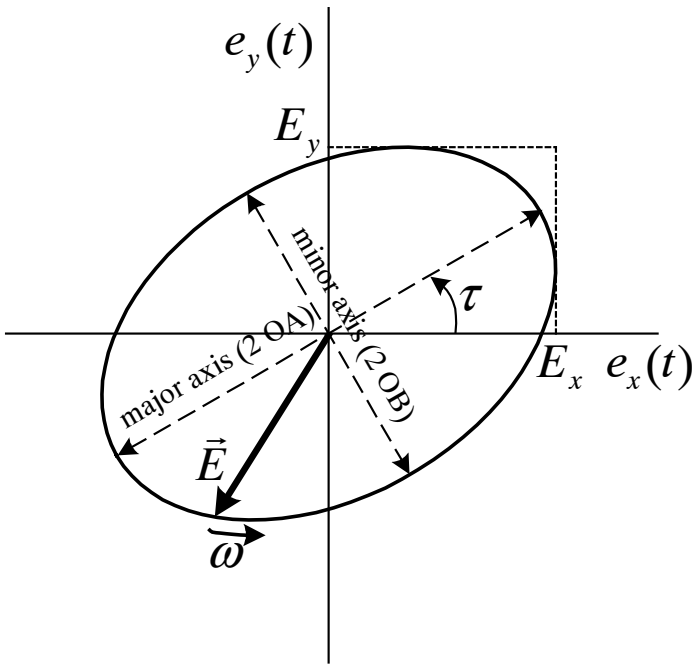
where:

$$x(t) = \frac{e_x(t)}{E_x \sin \delta_L} = \frac{\cos \omega t}{\sin \delta_L};$$

$$y(t) = \frac{e_y(t)}{E_y \sin \delta_L} = \frac{\cos(\omega t + \delta_L)}{\sin \delta_L}$$

Equation (5.7) is the parametric equation of an ellipse centered in the $x - y$ plane. It describes the motion of a point of coordinates $e_x(t)$ and $e_y(t)$ along an ellipse with a frequency ω.

The elliptical polarization can also be *right-hand* and *left-hand* polarization, depending on the relation between the direction of propagation and the direction of rotation.



The parameters of the polarization ellipse are given below. Their derivation is given in Appendix I.

a) major axis $(2\times \mathrm{OA})$

$$\mathrm{OA} = \sqrt{\frac{1}{2}\left[E_x^2 + E_y^2 + \sqrt{E_x^4 + E_y^4 + 2E_x^2 E_y^2 \cos(2\delta_L)} \right]} \tag{5.8}$$

b) minor axis $(2\times \mathrm{OB})$

$$\mathrm{OB} = \sqrt{\frac{1}{2}\left[E_x^2 + E_y^2 - \sqrt{E_x^4 + E_y^4 + 2E_x^2 E_y^2 \cos(2\delta_L)} \right]} \tag{5.9}$$

c) tilt angle τ

$$\tau = \frac{1}{2}\arctan\left(\frac{2E_x E_y}{E_x^2 - E_y^2}\cos\delta_L \right) \tag{5.10}$$

d) axial ratio

$$AR = \frac{\text{major axis}}{\text{minor axis}} = \frac{\mathrm{OA}}{\mathrm{OB}} \tag{5.11}$$

Note: The linear and circular polarizations can be considered as special cases of the elliptical polarization.

- If $\delta_L = \pm\left(\frac{\pi}{2} + 2n\pi\right)$ and $E_x = E_y$, then $\mathrm{OA} = \mathrm{OB} = E_x = E_y$; the ellipse becomes a circle.

- If $\delta_L = n\pi$, then $\mathrm{OB} = 0$ and $\tau = \pm\arctan\left(\frac{E_x}{E_y}\right)$; the ellipse collapses into a line.

3. Field polarization in terms of two circularly polarized components

The representation of a complex vector field in terms of circularly polarized components is somewhat less easy to perceive but it is actually more useful in the calculation of the polarization ellipse parameters.

$$\vec{E} = \tilde{E}_R(\hat{x} + j\hat{y}) + \tilde{E}_L(\hat{x} - j\hat{y}) \tag{5.12}$$

Assuming a relative phase difference of $\delta_C = \varphi_L - \varphi_R$, one can write (5.12) as:

$$\vec{E} = E_R(\hat{x} + j\hat{y}) + E_L e^{j\delta_C}(\hat{x} - j\hat{y}) \tag{5.13}$$

The relation between the linear-component and the circular-component representations of the field polarization is easily found as:

$$\vec{E} = \hat{x}\underbrace{(\tilde{E}_R + \tilde{E}_L)}_{\tilde{E}_x} + \hat{y}\underbrace{j(\tilde{E}_R - \tilde{E}_L)}_{\tilde{E}_y} \tag{5.14}$$

4. Polarization vector and polarization ratio

> The *polarization vector* is the normalized phasor of the electric field vector. It is a complex-number vector of unit magnitude and direction coinciding with the direction of the electric field vector.

$$\hat{\rho}_L = \frac{\vec{E}}{E_m} = \hat{x}\cdot\frac{E_x}{E_m} + \hat{y}\cdot\frac{E_y}{E_m}e^{j\delta_L}, \quad E_m = \sqrt{E_x^2 + E_y^2} \tag{5.15}$$

The polarization vector takes the following forms in some special cases:

Case 1: Linear polarization

$$\hat{\rho}_L = \hat{x}\cdot\frac{E_x}{E_m} \pm \hat{y}\cdot\frac{E_y}{E_m}, \quad E_m = \sqrt{E_x^2 + E_y^2} \tag{5.16}$$

Case 2: Circular polarization

$$\hat{\rho}_L = \frac{1}{\sqrt{2}}(\hat{x} \pm \hat{y} \cdot j), \quad E_m = \sqrt{2} \cdot E_x = \sqrt{2} \cdot E_y \tag{5.17}$$

The *polarization ratio* is the ratio of the phasors of the two orthogonal polarization components. It is a complex number.

$$\tilde{r}_L = r_L e^{\delta_L} = \frac{\tilde{E}_y}{\tilde{E}_x} = \frac{E_y e^{j\delta_L}}{E_x} \text{ or } \tilde{r}_L = \frac{\tilde{E}_V}{\tilde{E}_H} \tag{5.18}$$

Point of interest: In the case of circular polarization, the polarization ratio is defined as:

$$\tilde{r}_C = r_C e^{j\delta_C} = \frac{\tilde{E}_R}{\tilde{E}_L} \tag{5.19}$$

The circular polarization ratio $\tilde{r}_C$ is of particular interest since the axial ratio of the polarization ellipse *AR* can be expressed as:

$$AR = \frac{r_C + 1}{r_C - 1} \tag{5.20}$$

Besides, its tilt angle is:

$$\tau = \frac{\delta_C}{2} \tag{5.21}$$

Comparing (5.10) and (5.21) readily shows the relation between the phase difference of the circular-polarization representation and the linear polarization ratio $\tilde{r}_L = r_L e^{j\delta_L}$:

$$\delta_C = \arctan\left(\frac{2r_L}{1 - r_L^2}\cos\delta_L\right) \tag{5.22}$$

One can calculate r_C from the linear polarization ratio $\tilde{r}_L$ making use of (5.11) and (5.20):

$$\frac{r_C + 1}{r_C - 1} = \sqrt{\frac{1 + r_L^2 + \sqrt{1 + r_L^4 + 2r_L^2\cos(2\delta_L)}}{1 + r_L^2 - \sqrt{1 + r_L^4 + 2r_L^2\cos(2\delta_L)}}} \tag{5.23}$$

Using (5.22) and (5.23) allows easy switching between the representation of the wave polarization in terms of linear and circular components.

5. Antenna polarization

The polarization of a radiated wave (polarization of a radiating antenna) at a specific point in the far zone is the polarization of the locally plane wave.

The polarization of a received wave (polarization of a receiving antenna) is the polarization of a plane wave, incident from a given direction, and having given power flux density, which results in maximum available power at the antenna terminals.

6. Polarization loss factor and polarization efficiency

Generally, the polarization of the receiving antenna is not the same as the polarization of the incident wave. This is called ***polarization mismatch***.

The polarization loss factor (PLF) characterizes the loss of EM power because of polarization mismatch.

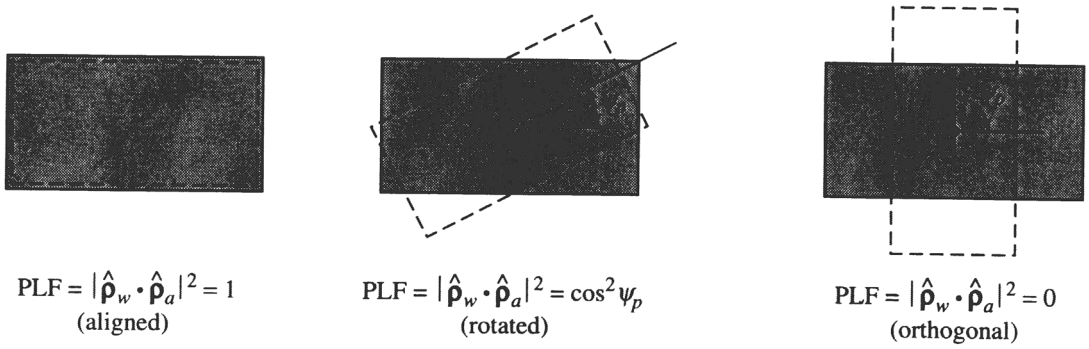
$$\text{PLF} = |\hat{\rho}_i \cdot \hat{\rho}_a|^2 \tag{5.24}$$

The above definition is based on the representation of the incident field and the antenna polarization by their polarization vectors. If the incident field is

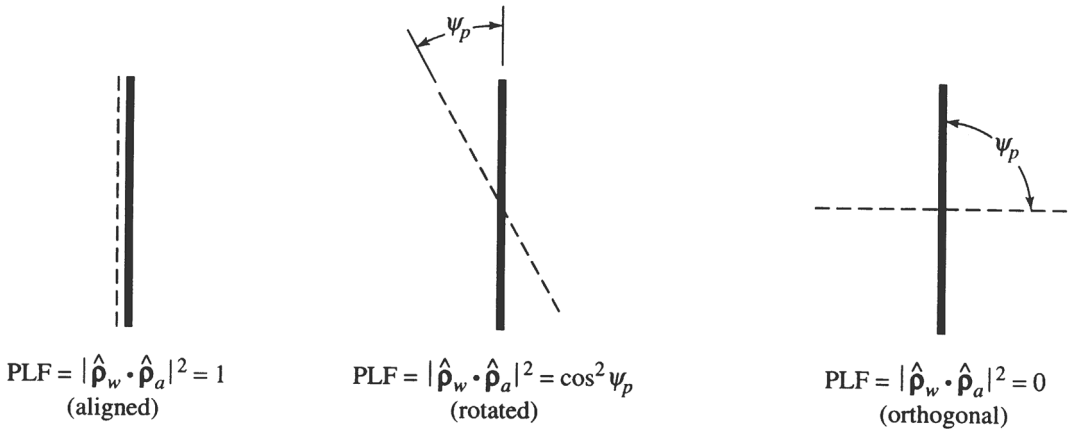
$$\vec{E}^i = E_m^i \hat{\rho}_i,$$

then the field of the same magnitude that would produce maximum received power at the antenna terminals is

$$\vec{E}_a = E_m^i \hat{\rho}_a.$$



(a) PLF for transmitting and receiving aperture antennas



If the antenna is polarization matched, then $\mathrm{PLF} = 1$, and there is no polarization power loss. If $\mathrm{PLF} = 0$, then the antenna is incapable of receiving the signal.

$$0 \le \mathrm{PLF} \le 1 \tag{5.25}$$

The ***polarization efficiency*** has the same physical meaning as the PLF.

Examples

Example 5.1. The electric field of a linearly polarized EM wave is

$$\vec{E}^i = \hat{x} \cdot E_m(x, y) e^{-j\beta z}$$

It is incident upon a linearly polarized antenna whose polarization is:

$$\vec{E}_a = (\hat{x} + \hat{y}) \cdot E(r, \theta, \varphi)$$

Find the PLF.

$$\mathrm{PLF} = \left| \hat{x} \cdot \frac{1}{\sqrt{2}} (\hat{x} + \hat{y}) \right|^2 = \frac{1}{2}$$

$$\mathrm{PLF}_{[\mathrm{dB}]} = 10 \log_{10} 0.5 = -3$$

Example 5.2. A transmitting antenna produces a far-zone field, which is right-circularly polarized. This field impinges upon a receiving antenna, whose polarization (in transmitting mode) is also right-circular. Determine the PLF.

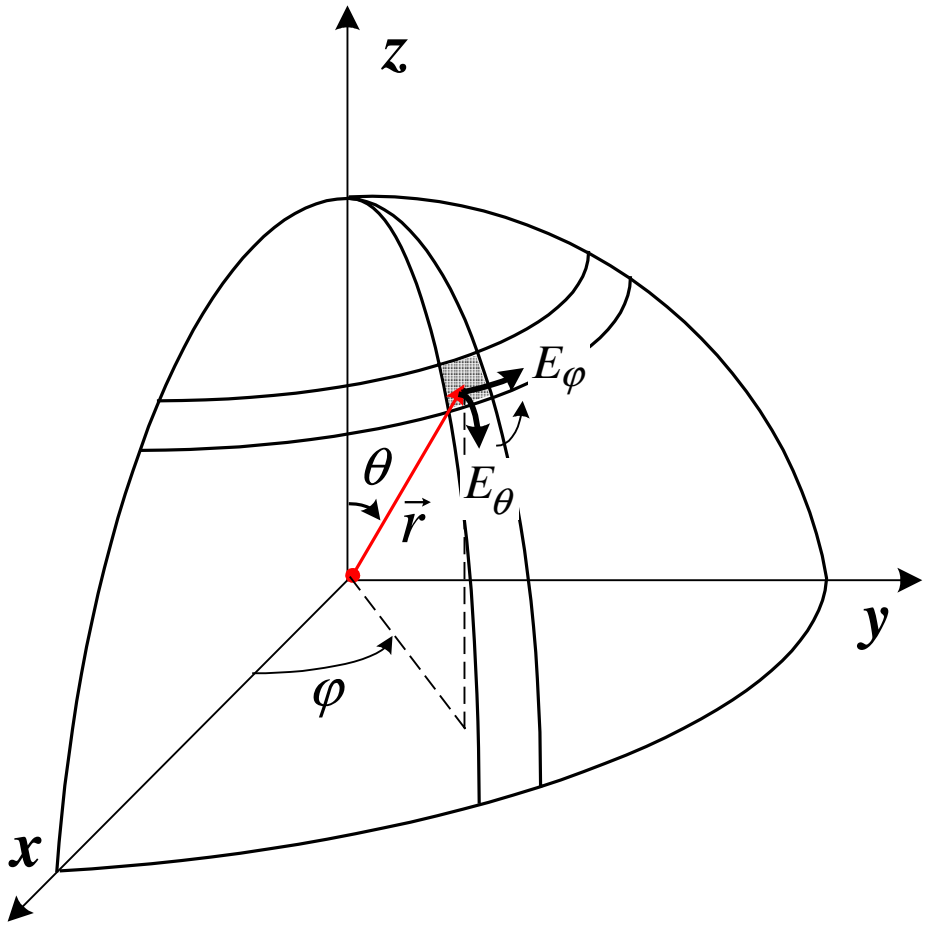
Both antennas (the transmitting one and the receiving one) are right-circularly polarized in transmitting mode. Let's assume that a transmitting antenna is located at the center of a spherical coordinate system. The far-zone field it would produce is described as:

$$\vec{E}^{\,far} = E_m \left[\hat{\theta} \cdot \cos \omega t + \hat{\varphi} \cdot \cos\left(\omega t - \pi / 2 \right) \right]$$

It is a right-circularly polarized field with respect to the outward radial direction. Its polarization vector is:

$$\hat{\rho} = \frac{\hat{\theta} - j\hat{\varphi}}{\sqrt{2}}$$

According to the definitions in Section 4, this is exactly the polarization vector of a transmitting antenna.



This same field $\vec{E}^{far}$ is incident upon a receiving antenna, which has the polarization vector $\hat{\rho}_a = \dfrac{\hat{\theta}_a - j\hat{\varphi}_a}{\sqrt{2}}$ in its own coordinate system $(r_a, \theta_a, \varphi_a)$. However, this field propagates along $-\vec{r}_a$ in the $(r_a, \theta_a, \varphi_a)$ coordinate system, and, therefore, its polarization vector becomes:

$$\hat{\rho}_i = \frac{\hat{\theta}_a + j\hat{\varphi}_a}{\sqrt{2}}$$

The PLF is calculated as:

$$\text{PLF} = |\hat{\rho}_i \cdot \hat{\rho}_a|^2 = \frac{|(\hat{\theta}_a + j\hat{\varphi}_a)(\hat{\theta}_a - j\hat{\varphi}_a)|^2}{4} = 1, \ \text{PLF}_{[\text{dB}]} = 10\log_{10} 1 = 0$$

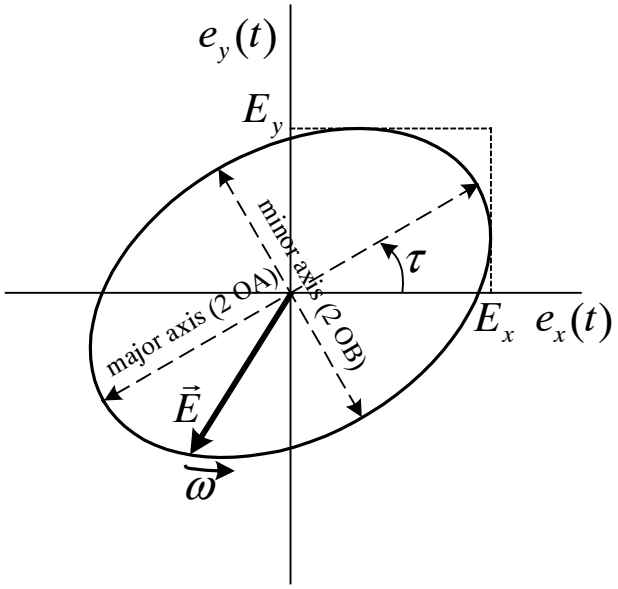
There are no polarization losses.

Exercise: Show that an antenna of right-circular polarization (in transmitting mode) cannot receive left-circularly polarized incident wave (or a wave emitted by a left-circularly polarized antenna).

Appendix I

Find the tilt angle τ, the length of the major axis OA, and the length of the minor axis OB of the ellipse described by the equation:

$$\sin^2\delta = \left[\frac{e_x(t)}{E_x}\right]^2 - 2\left[\frac{e_x(t)}{E_x}\right]\left[\frac{e_y(t)}{E_y}\right]\cos\delta + \left[\frac{e_y(t)}{E_y}\right]^2 \qquad \text{(A-1)}$$



Equation (A-1) can be written as:

$$a \cdot x^2 - b \cdot xy + c \cdot y^2 = 1, \qquad \text{(A-2)}$$

where:

$x = e_x(t)$ and $y = e_y(t)$ are the coordinates of a point of the ellipse centered in the $x - y$ plane;

$$a = \frac{1}{E_x^2 \sin^2\delta};$$

$$b = \frac{2\cos\delta}{E_x E_y \sin^2\delta};$$

$$c = \frac{1}{E_y^2 \sin^2 \delta}.$$

After dividing both sides of (A-2) by (xy), one obtains

$$a\frac{x}{y} - b + c\frac{y}{x} = \frac{1}{xy} \tag{A-3}$$

Introducing $\xi = \frac{y}{x} = \frac{e_y(t)}{e_x(t)}$, one obtains that

$$x^2 = \frac{1}{c\xi^2 - b\xi + a}$$

$$\Rightarrow \rho^2(\xi) = x^2 + y^2 = x^2(1+\xi^2) = \frac{(1+\xi^2)}{c\xi^2 - b\xi + a} \tag{A-4}$$

Here, ρ is the distance of the ellipse point from the center of the coordinate system. We want to know at what ξ values the maximum and the minimum of ρ occur. This will produce the tilt angle τ. We also want to know what are the values of $\rho_{\max}$ and $\rho_{\min}$. Then, we have to solve

$$\frac{d(\rho^2)}{d\xi} = 0, \text{ or}$$

$$\xi^2 - \frac{2(a-c)}{b}\xi - 1 = 0 \tag{A-5}$$

(A-5) is better solved for the angle α, such that

$$\xi = \tan\alpha = \frac{y}{x}; \quad \alpha = \frac{\pi}{2} - \tau \tag{A-6}$$

Substituting (A-6) in (A-5) yields:

$$\left(\frac{\sin\alpha}{\cos\alpha}\right)^2 - 2C\left(\frac{\sin\alpha}{\cos\alpha}\right) - 1 = 0 \quad \left|\times\cos^2\alpha\right. \tag{A-7}$$

where $C = \frac{a-c}{b} = \frac{E_y^2 - E_x^2}{2E_xE_y\cos\delta}$.

The solution of (A-7) is:

$$\alpha_1 = \frac{1}{2}\arctan\left(\frac{2E_xE_y\cos\delta}{E_x^2 - E_y^2}\right);\ \ \alpha_2 = \alpha_1 + \frac{\pi}{2}$$
$$\Rightarrow \tau_{1,2} = \alpha_{1,2} \qquad \text{(A-8)}$$

Substituting α_1 and α_2 back in ρ yields the expressions for OA and OB.

BA- Butterfly Antenna

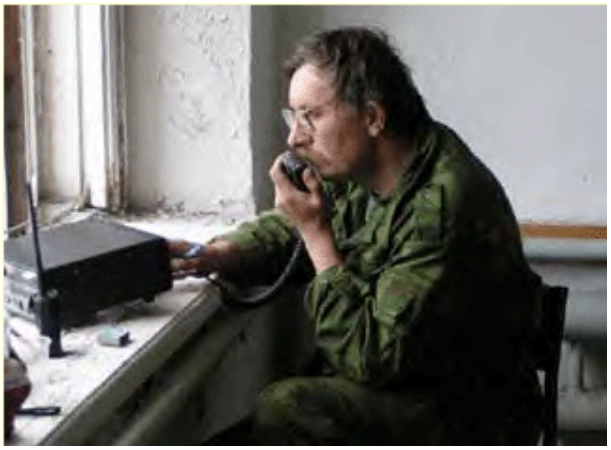
By: N. Filenko, UA9XBI ua9xbi@online.ru

Credit Line: www.cqham.ru

The antenna is a version of a shunt fed loop (**Reference 1**). However, the antenna has some advantage compare to a version from **Reference 1**.

1. Input impedance is closed to 50 Ohm.
2. The antenna has more narrow diagram directivity.
3. Easy to installation. It could be hanged between trees, trees and house, etc.

Figure 1 shows the antenna at a horizontal installation. **Figure 2** shows the diagram directivity of the antenna at its height 5 meters over real ground. Mostly vertical polarization is at the installation. **Figure 3** shows the SWR the antenna at its height 5 meters over real ground. **Figure 4** shows input impedance the antenna at its height 5 meters over real ground. The plots were taken with help of MMANA (**Reference 2**).



UA9XBI
Radio club 'Arktika' Championship 2004
Photo Credit Line:
http://www.arktika.komi.com/Champ_2004.htm

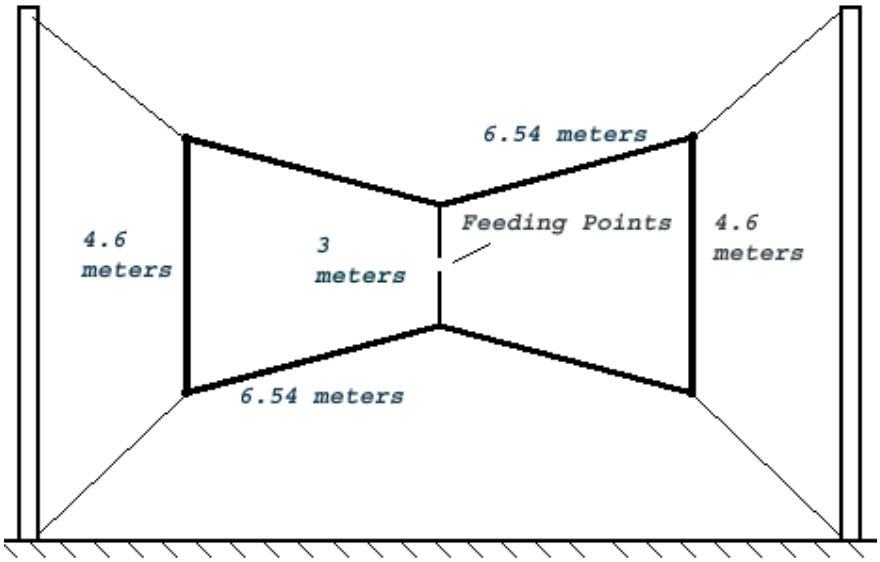
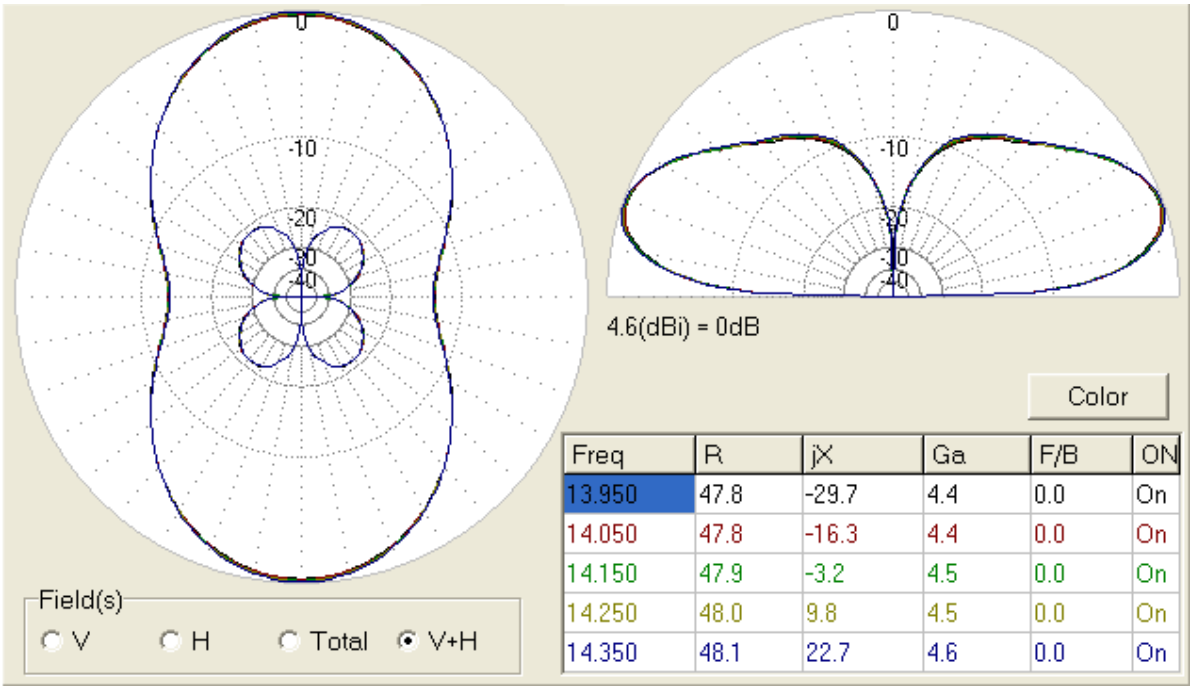


Figure 1 Butterfly Antenna at Horizontal Installation

http://www.cqham.ru/



Freq	R	jX	Ga	F/B	ON
13.950	47.8	-29.7	4.4	0.0	On
14.050	47.8	-16.3	4.4	0.0	On
14.150	47.9	-3.2	4.5	0.0	On
14.250	48.0	9.8	4.5	0.0	On
14.350	48.1	22.7	4.6	0.0	On

Figure 2 **Diagram Directivity of the Antenna at Its Height 5 meters Over Real Ground**

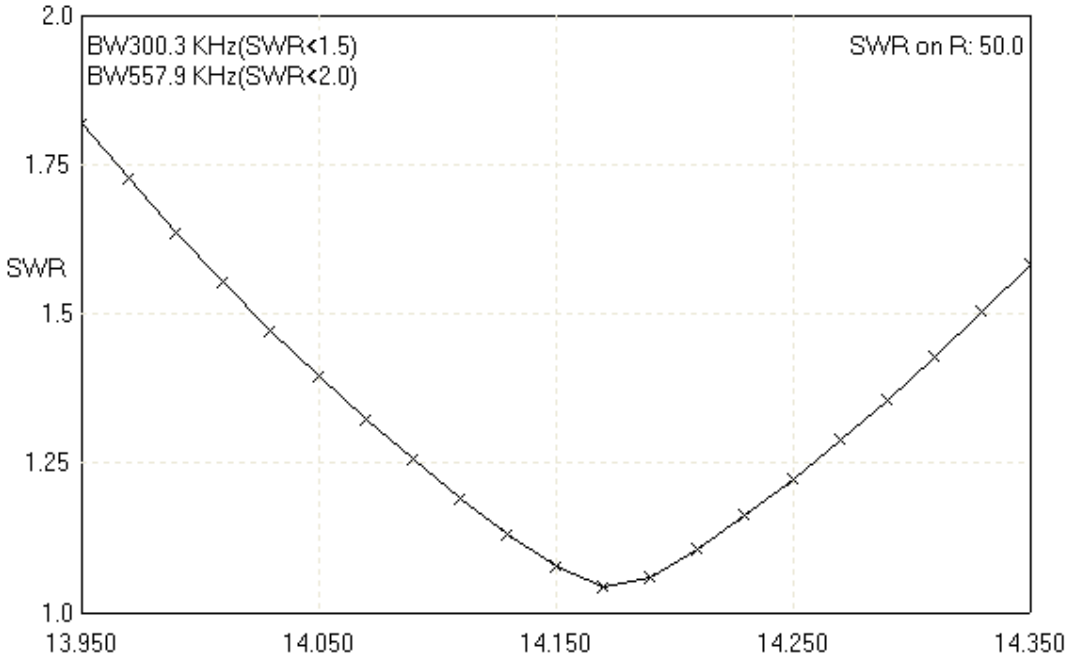


Figure 3 **SWR the Antenna Its Height 5 meters Over Real Ground**

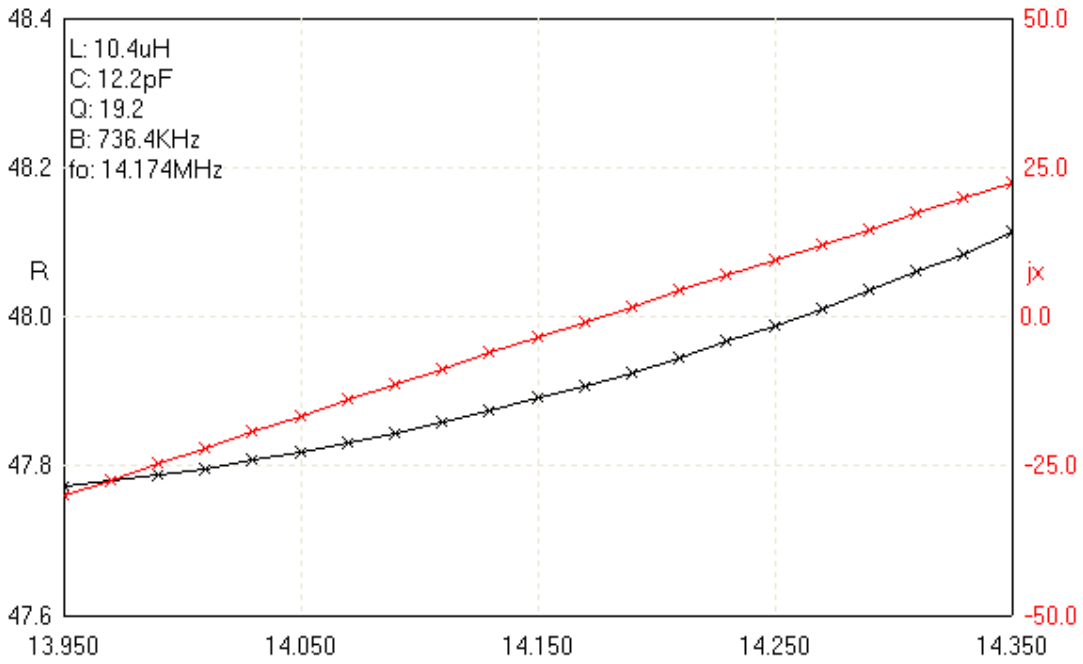


Figure 4 Impedance of the Antenna at Its Height 5 meters Over Real Ground

Antenna parameters at antenna horizontal installation are very depended on ground properties. The more wet ground the stronger main lobe is declined to the ground, I. e., the better antenna works for DX. **Figure 5** shows the antenna at a vertical horizontal installation.

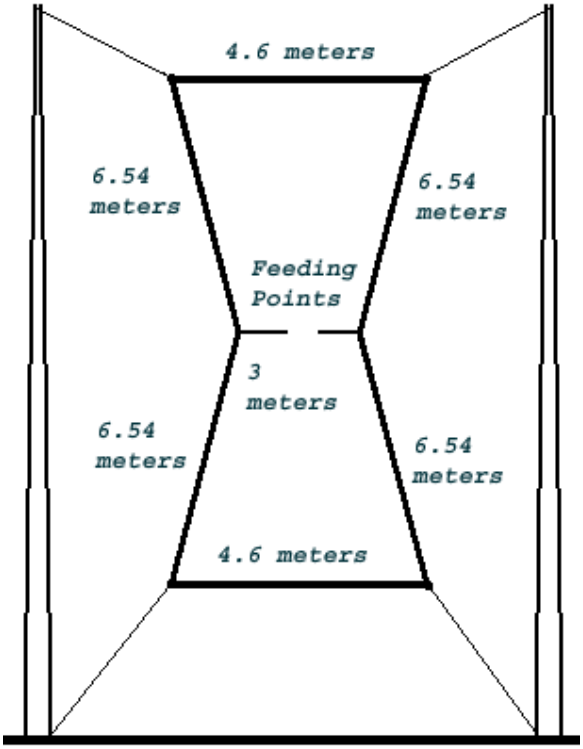
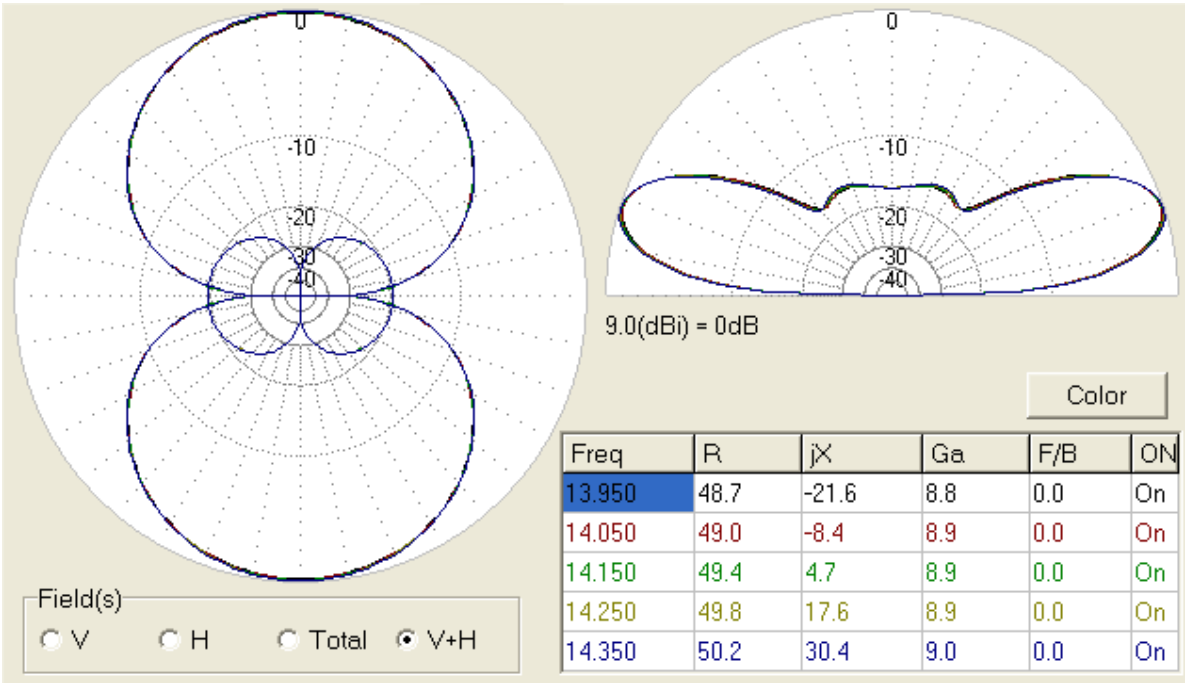


Figure 5 Butterfly Antenna at Vertical Installation

Figure 6 shows the diagram directivity of the antenna at its height 7 meters over real ground.Mostly horizontal polarization is at the installation. **Figure 7** shows the SWR the antenna at its height 7 meters over real ground.

Figure 8 shows input impedance the antenna at its height 7 meters over real ground. The plots were taken with help of MMANA (**Reference 2**).



Freq	R	jX	Ga	F/B	ON
13.950	48.7	-21.6	8.8	0.0	On
14.050	49.0	-8.4	8.9	0.0	On
14.150	49.4	4.7	8.9	0.0	On
14.250	49.8	17.6	8.9	0.0	On
14.350	50.2	30.4	9.0	0.0	On

Figure 6 Diagram Directivity of the Antenna at Its Height 7 meters Over Real Ground

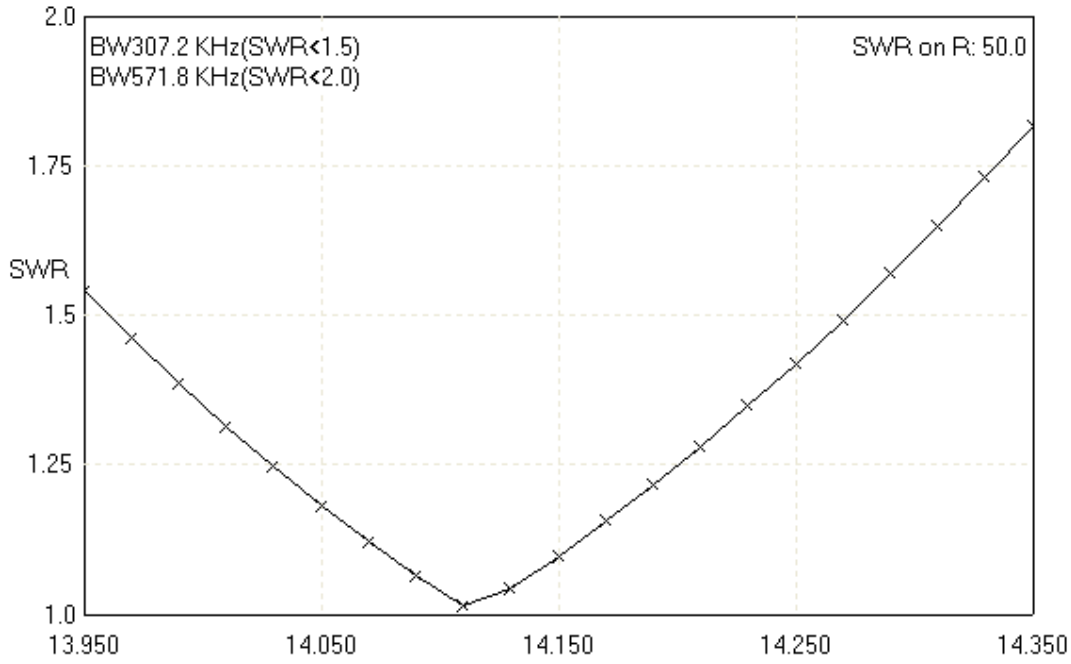


Figure 7 SWR the Antenna Its Height 7 meters Over Real Ground

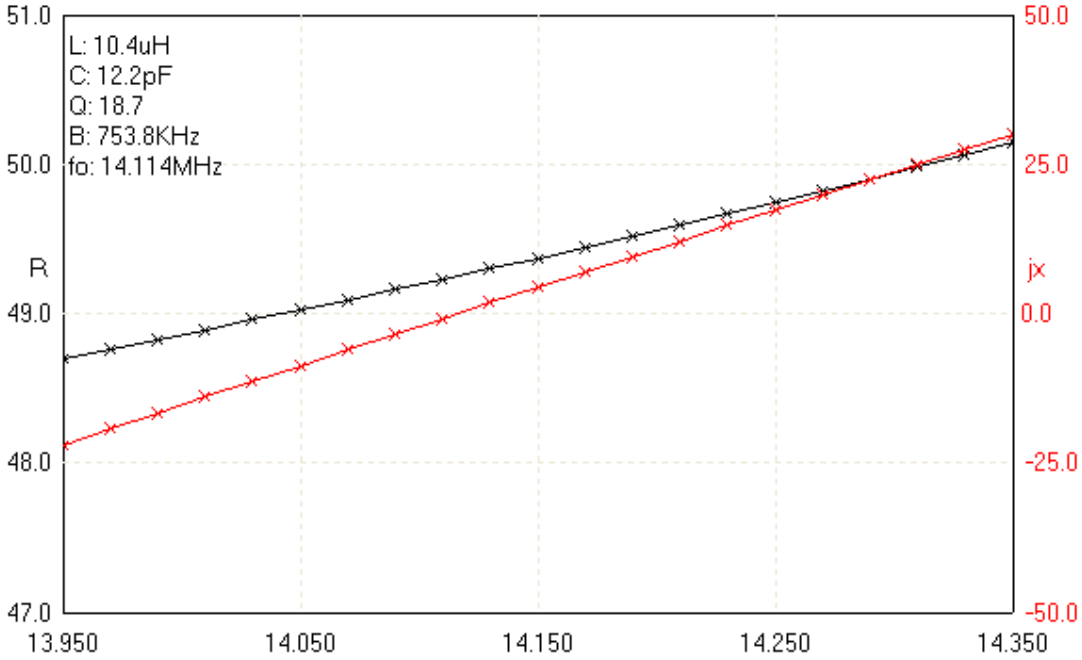
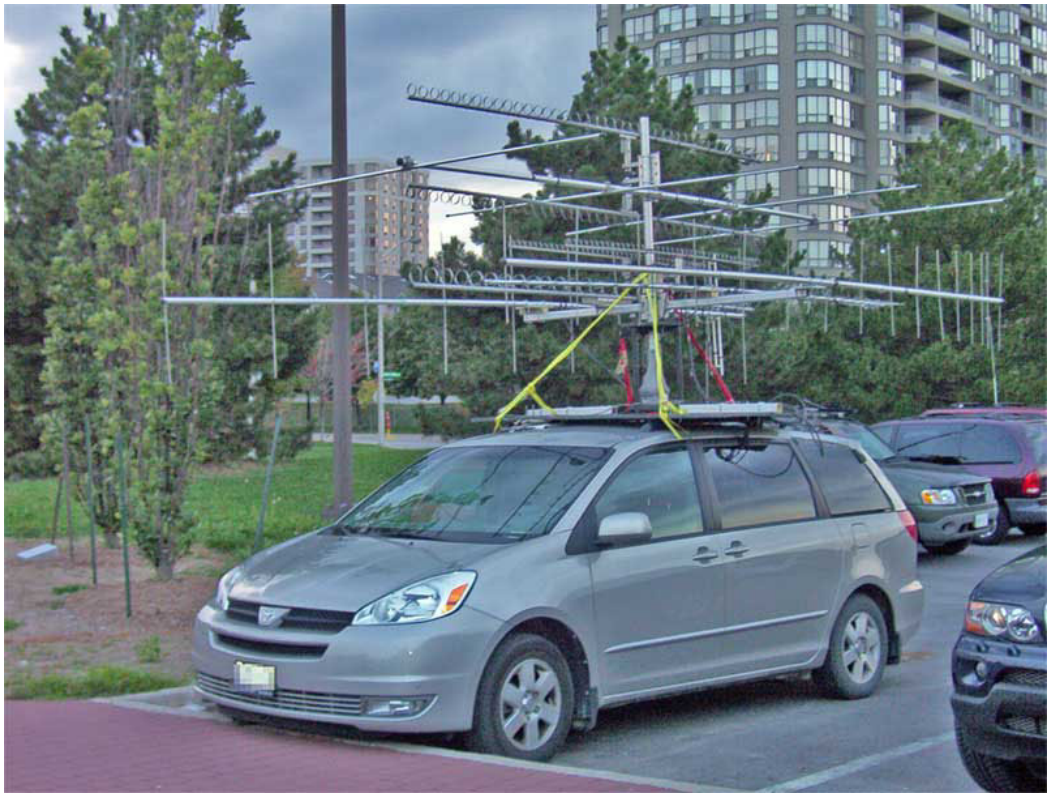


Figure 8 Impedance of the Antenna at Its Height 7 meters Over Real Ground

Antenna was made from bare copper wire in 4 mm diameter. May be used any 50 Ohm coax for feeding the antenna. Try place the coax athwart to antenna at least 5 meter.

References:

1. **Antennas for Radio Amateurs**
By Igor Grigorov, RK3ZK. Antentop -1-2007, Antentop 2- 2004
2. **MMANA is free for Amateur Radio Use**
http://mmhamsoft.ham-radio.ch/



UR5WCA Balcony Antenna for 7, 10 and 14 MHz

By: Valeriy Prodanov, UR5WCA
ur5wca@ukr.net

Credit Line: www.cqham.ru

As I am an urban resident I have not a sufficient place for my antenna. My balcony placed at 2- floor at 5- store building is my sole antenna polygon. So, I have done a balcony antenna for my favorite 7, 10 and 14 MHz-ranges. It is a helical vertical that can be matched for these bands. **Figure 1** shows the view of the antenna. **Figure 2** shows the schematic of the antenna.

Figure 1 UR5WCA Balcony Antenna

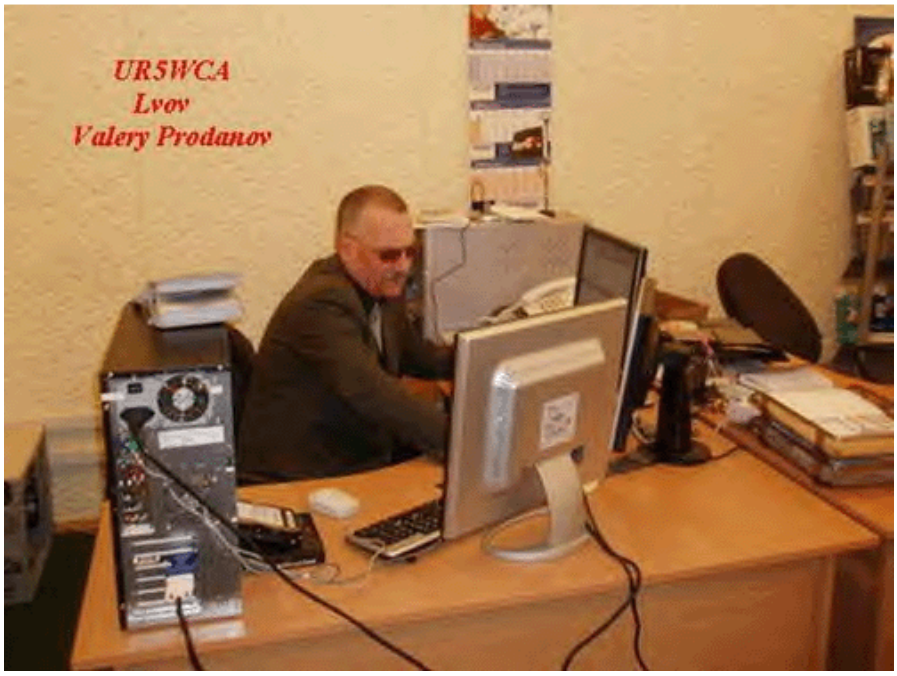
Design of the antenna:

- Two verticals were made from PVC tube in 5 centimeters diameter.

- On length of 1.35 meter of each tube were coiled 11.5 meters of insulated copper wire in 1- mm (18 AWG) diameter

- Distance between the verticals is 1 meter

At antenna clips an ATU (see **References 1**) was used with the antenna. **Figure 3** shows the picture of the ATU. ATU (between coax and transceiver) is a must for the antenna.



SWR at 7, 10 and 14 MHz was near 1:1,1. While two weeks running the antenna on the bands I did a hundred CW QSO with practically of all the European countries and some district of Asia of the former USSR. I have received 569… 599. The antenna works with low SWR at 80- meters, however only local QSO was done. At 18 MHz the antenna has SWR 1:2. For testing the antenna I used a home- brew transceiver made on the base of old Russian receiver R-250 and ATU MFJ- 945E.

Modification of the UR5WCA Balcony Antenna for 7, 10 and 14- MHz

Figure 4 shows modification of the antenna that increases it performance. Inductors L1 and L2 were coiled by insulated copper wire in 1.5-mm (15- AWG) diameter, spacing between turns is 2-mm. Form diameter is 35- mm (was used PVC tape tubes), numbers of turns are 29, tap from 9 turn from cold end. FSM (Field Strength Meter) displayed increasing of electromagnetic field to 30% compare to antenna without matching coils.

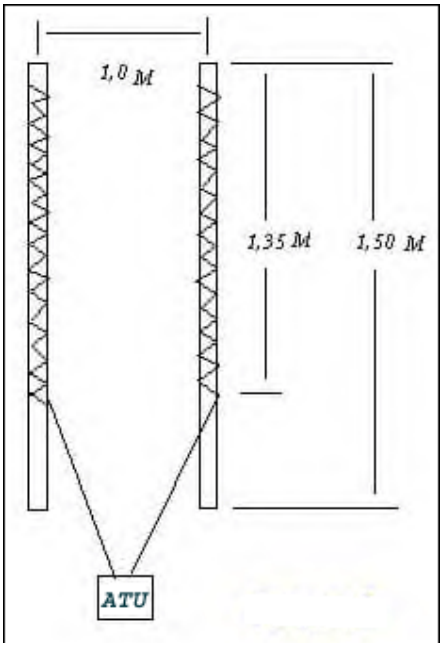


Figure 2 Schematic of the UR5WCA Balcony Antenna

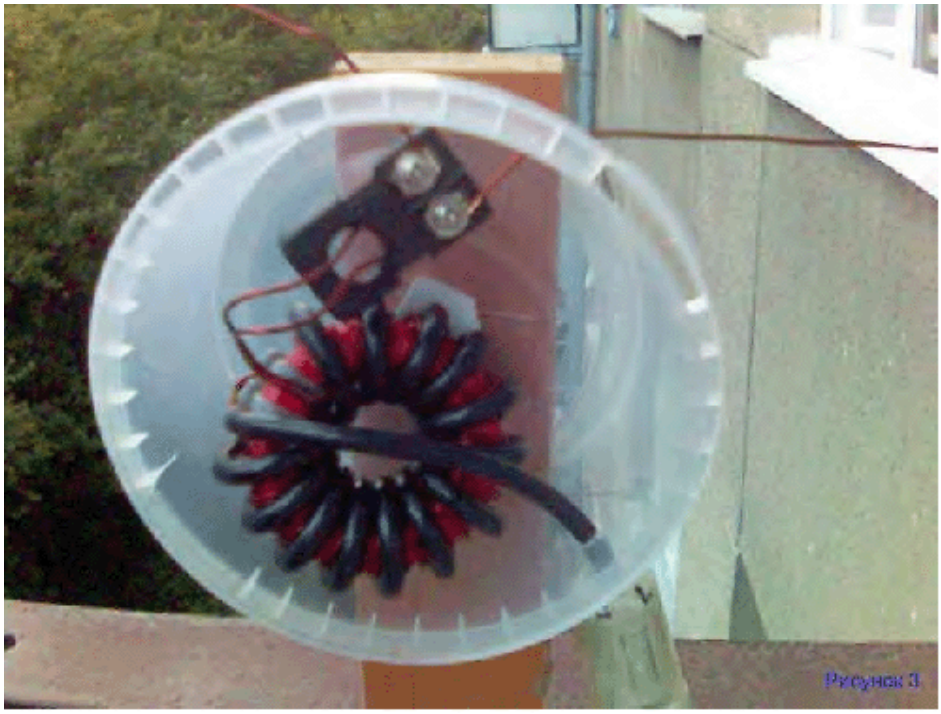


Figure 3 ATU of the UR5WCA Balcony Antenna

The measurement was made at distance 5 meter far the antenna. At antenna clips an ATU (see **References 1**) was used with the antenna. ATU (between coax and transceiver) is a must for the antenna.

After numbers tests I did another modification.

1. Each vertical contains 20.2 meters of insulated copper wire in 1.5-mm (15- AWG) diameter.

2. The coils (see **Figure 4**) were deleted and verticals were connected straight away to pre ATU (see **Figure 5**).

3. A counterpoise (I used metal balcony hand-rail) was used with the antenna.
After this modification noise level decreased, SWR was not changed. ATU (between coax and transceiver) is a must for the antenna. With the antenna I did some DX QSOs, for example, with KH0DQ (10-MHz, 589 to me) and 5Z4LS (14-MHz, 599 to me).

Conclusion: Of course, it is only a surrogate antenna, but the antenna is worked, and works not bad.

References:

. http://www.qsl.net/gw6hmj/antenna.htm

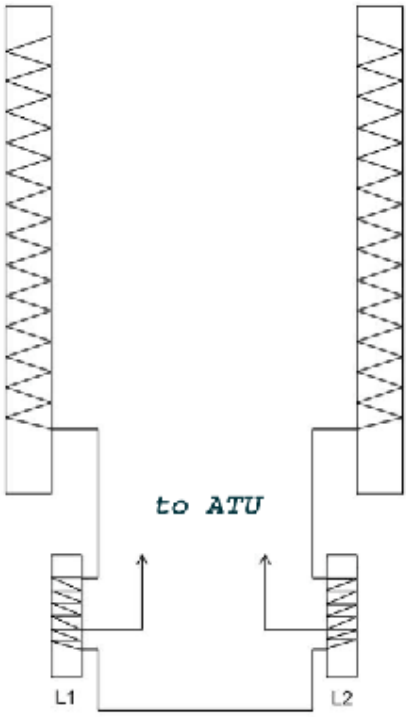


Figure 4 Modification of the UR5WCA Balcony Antenna

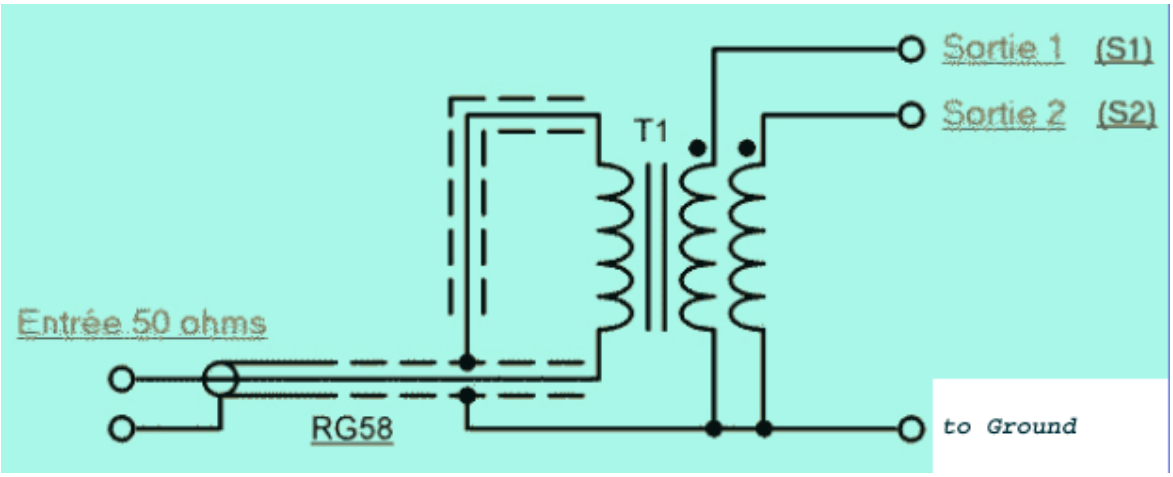


Figure 5 ATU of the UR5WCA Balcony Antenna

Circle Antenna

By ***Simuhin Aleksandr, RA3ARN*** *(ra3arn@mail.ru)*

How is it happened that I did the antenna? Propagation on the 10 meter band pushed me to do the antenna. Propagation was coming, but I had not any antenna at my cottage. I really need an antenna. I have red at a text book that antenna having shape like a circle has a good characteristics. So, I decided to do a “Circle Antenna” and went to a local Home - Repair store for stuff for the antenna

RA3ARN

I have found what I was looking for. I bought cheapest plastic tube for cold water, however, inside the plastic it was a metal tube in thick near 0.6 mm. I have bought 11 meters for 7 USD.

Installation of the antenna was a very simple matter. I did the tube straight, in the center of the tube I did a hole, with help of a screw I attached the tube to the highest point of my wooden cottage.

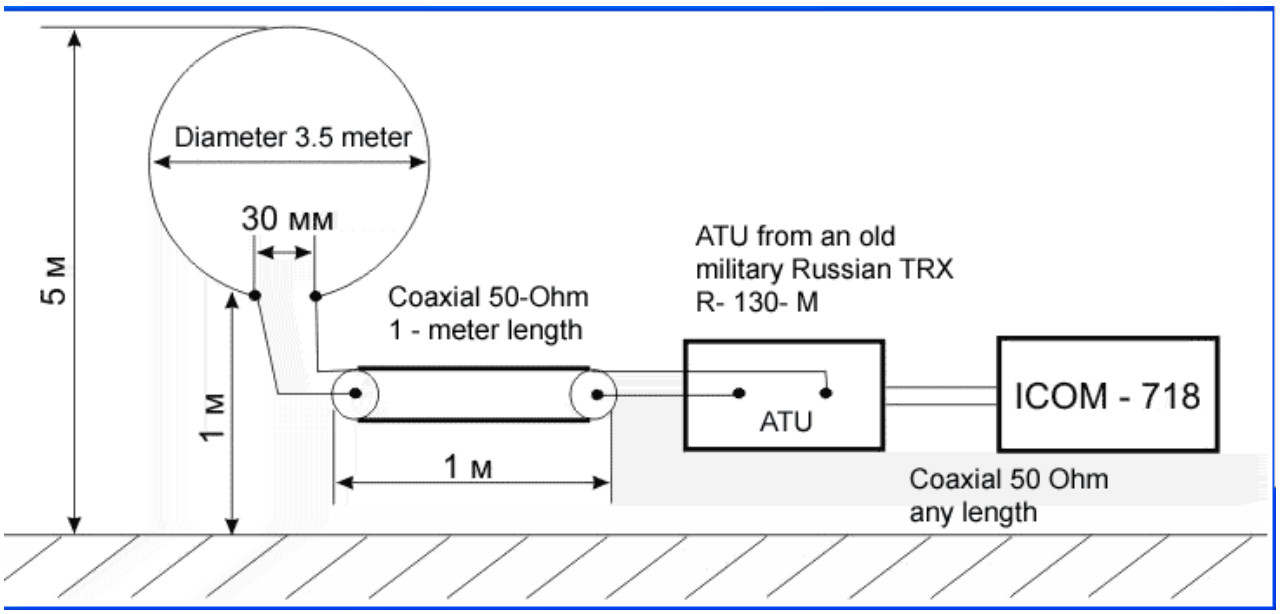
Then I shaped the tube in a circle, did several holes on the tube, with help screws did fastened the tube to the wooden wall of my cottage. That is all! Antenna is ready.

An one- meter length of a 50- Ohms Coaxial Cable was attached between the antenna and ATU from an old military Russian radio R- 130M. With help the ATU I managed to get the SWR 1:1 at all amateur HF-bands, from 10 t0 160 meters.

Lots interesting DX QSOs were made on the upper HF bands. I was surprised how the antenna was working on the 160 meter band. I had QSOs with almost all former region of the USSR at the 160 meters.

Of course, the antenna is not perfect but it allowed me work well from my country cottage and had lots fun.

73 and DX! Simuhin Aleksandr, RA3ARN (ra3arn@mail.ru)



Mystery of theBroom Antenna

V. T. Polaykov, RA3AAE, Ph. D in technical science

Well known in Russia broom antenna has some mysterious property. What is the property- the puzzle try to solve Vladimir Polaykov.

1. History of the Broom Antenna (BA)

Broom Antenna has been well known in the USSR from old times. I have a Russian amateurs magazine from 1935 **[1]** with description of the antenna. “The antenna is made from a bunch of lengths of wires. There are used wires by 23 centimeters long. Narrow end of the bunch is inserted to an porcelain insulator. Wires in the bunch had angle in 15 degree from the center. A copper wire 15 meters long is going from the bunch to a receiver.” I cannot do scan for the figure from the magazine because its bad condition. However I pictured it possible to close to the original figure. **Figure 1** shows the design of the broom antenna. The antenna was conveniently for the times because it needs only one mast for its installation.

V. T. Polaykov, RA3AAE

Plate 8.4 Twelfth-century mural of the goddess Frigga riding a distaff, in the cathedral at Schleswig, Schleswig-Holstein, Germany. Nigel Pennick.

A witch usually used a Broom like a modern Jet

Sometimes the antenna was installed at a chimney, so no any mast was required. Up to our times the antenna is used for the radio reception (**References [2, 3]**).

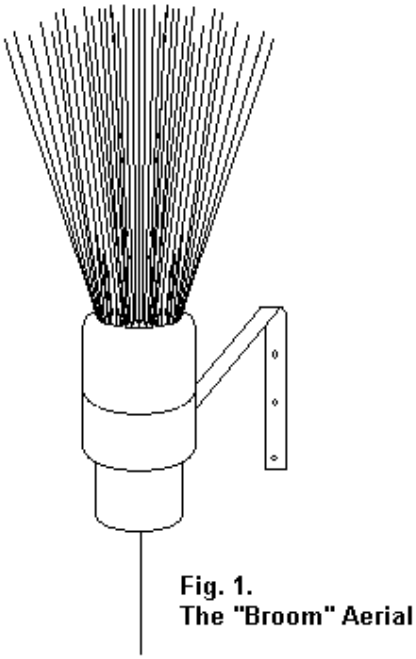


Figure 1 Design of the broom antenna

(***Note by I. G.:*** I had a book published at 1922 in Moscow where BA was described. However, at the book the antenna had a Reference back to 1916 year. It is a pity that I cannot take with me the old book in Canada. It is need to have a permission for any book older then 50 years to take the book abroad of Russia. It is not easy to obtain such permission, so lots old books were lived by me at Russia… **Figure 01** shows a broom antenna from a book published at 1938 (original scan from book by A. P. Gorshkov "Handbook of Radio Amateur: Questions and Answers", published in 1938 in Moscow)

See also at horizontal antenna, competitor for the BA (**Figure 02**, original scan from the **[01].** The horizontal antenna was mostly popular at the 30s.)

At the magazine was written that an US company 'Central Equipment Ltd' produced the Broom Antenna. Wire going from the broom to a receiver was thoroughly insulated from walls with special insulators. Inside room the wire go through a special ebonite tube. It is pay attention the very careful isolation of the antenna wire from the nearest objects. A special grounding kit was included to the antenna.

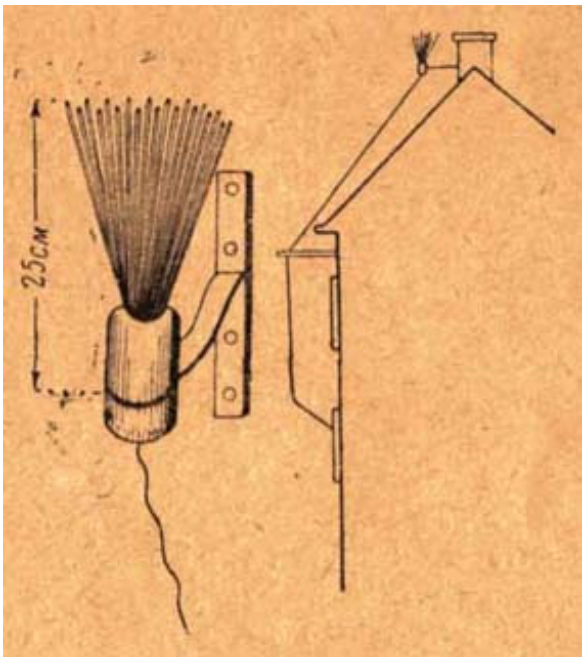


Figure 01 Broom antenna from a book published at 1938

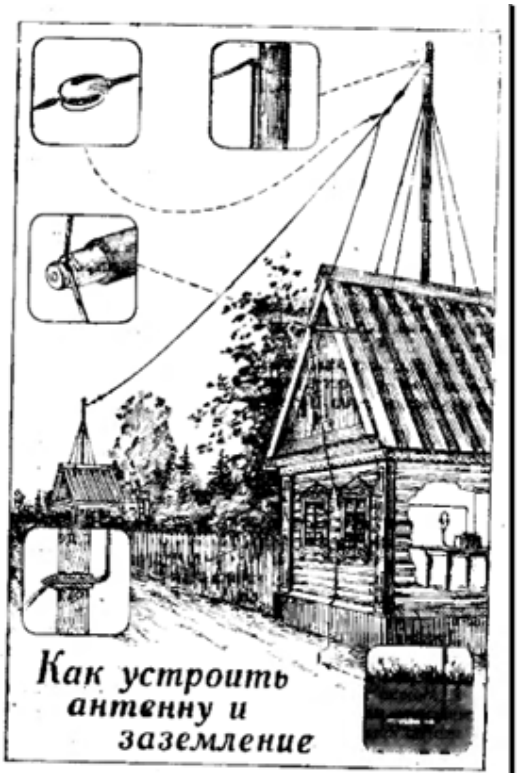


Figure 02 Horizontal Antenna

Figure 03 (***drawn by I.G. by Reference 1***) shows the grounding installed in the soil. It was a copper tube with holes filled by so name "silitit" (Russian hams at such grounding used instead the "silitit" a charcoal). Bunch of copper wires went down the tube. So, the grounding looks like a Broom Antenna reversed by the wires bunch to the ground. At advertise of the company was wrote: "…. Above the advantages of easy in the installation the antenna has advantages in the reception". Last phrase was puzzled me, what are the advantages?
As usual BA antenna is considered as wire antennas with a capacitive load. Capacitive load made like a metal sheet was used by Hertz and Popov **[02]**, capacitive loads made like several wires at the antenna end was used by Marconi **[02]**, capacitive loads made like wire's toroid was used by Tesla **[02]**. However, no one used a capacitive load made like a broom because it is not optimal implementation of this one.

Circle (having dimension like a broom antenna) with several radial wires will have the same capacity like the broom antenna. **Figure 2** shows a broom converted to an optimal capacitive load. At some description of the BA I found recommendation to use a strictly numbers of wires (19, 37 or 61 pieces) with length 50- 100 centimeters and use angle between center line and wires from 45 to 90 degree. Of course, it is nonsense. In theory 7 wires are enough for the antenna. BA made from 19- 37- 61 wires will have only a slightly more capacity compare to antenna made from 7 wires….

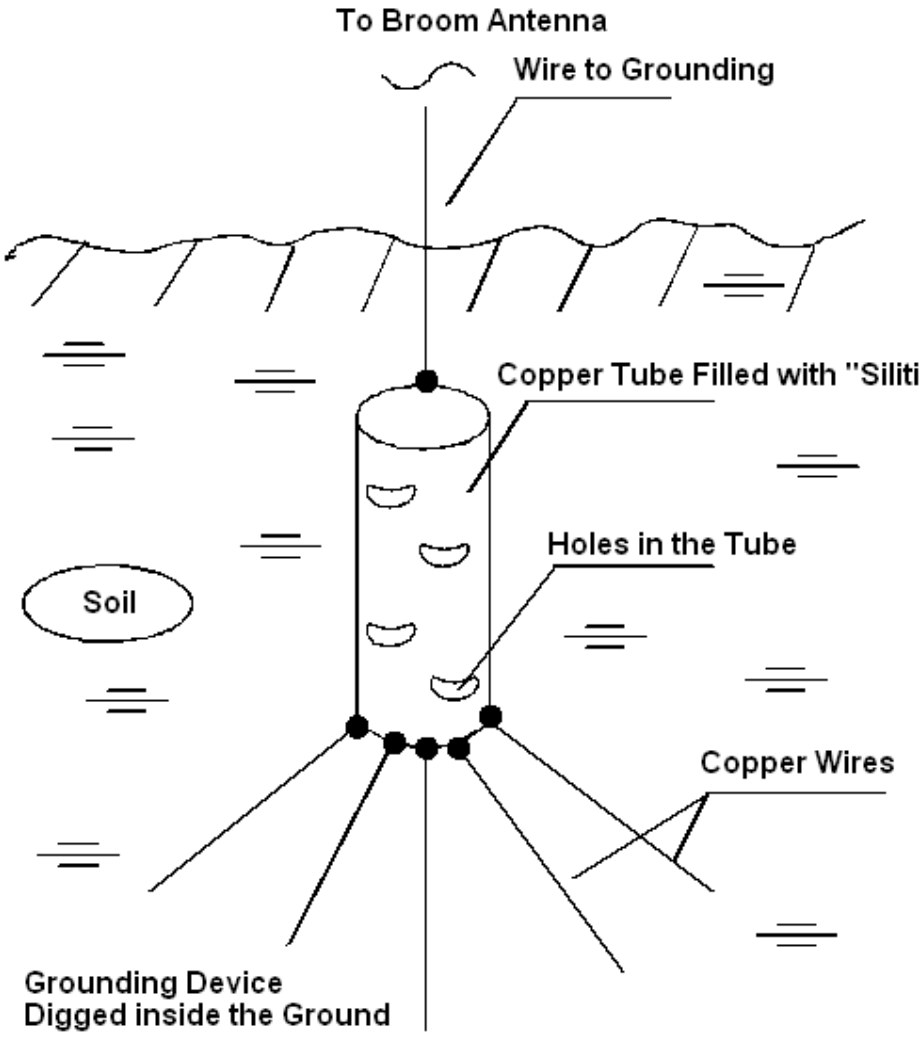


Figure 03 Grounding for Broom Antenna Installed in the Soil.

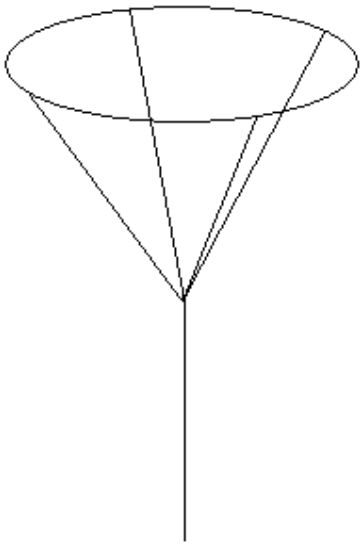


Fig. 2.
Better capacitive load

Figure 2 Broom converted to an optimal capacitive load

So in the theory there is no any advantage of the broom antenna before another antenna with a capacitive load.

However, a small metal 'broom' was used for discharging of some parts of electrostatic machines from 19 century. Recently the metal 'broom' are widely used at the end of antenna mast (that installed on the ground or on a ship), at the end of jet wings for leaking the static from the jet to the air. The 'broom' discharger looks like a Broom Antenna…

So, what is can discharge the broom from the antenna?

2. Atmospheric electricity

What are we know about an atmospheric electricity? Near the ground surface there is gradient of potential, i.e. strength of the electrostatic field is near 130 Volts/meter. At height of the human head the strength of the electrostatic field is near 200 Volts/meter. However we do not mention the potential because the air is very good insulator and current going through our body is too small. The more up the more potential will be. It is come due the follow effect. Upper layers of the Earth atmosphere are ionized (so called ionosphere) by the Sun rays. Ionosphere layer has some conductivity and charged positively (due some process) compare to the Ground surface. So, mankind lives between two plates of huge capacitor- one plate is the Ground another plate is the Ionosphere.

However it is a small ionic current flow down to the Ground. It is very- very small current. The current density being measured by a high sensitivity device is several pico- Amperes per square meter. Scientists do not clear explain the phenomenon. One of hypothesis says that the current exists due lightning and thunderstorm **[4]**. Really, before a thunderstorm the current is increased dramatically and sometimes we could register the effect visually. It is the corona discharge – bright glowing at the end of high metal mast, sometimes the corona charge is going from trees, wooden or metal cross at the top of churches. Corona discharge is especially bright in the mountains and in the sea (where the air is especially clear). Such Corona Discharge had been well known from the very old times, it was called *Saint Elmo's fire.*

Saint Elmo's fire

Atmospheric electricity had been studied from 17- century **[5]**. Lots great scientists (in the US Benjamin Franklin **[03]** the inventor of the lightning rod, in Italy Giovanni Beccaria **[04]**, in Russia- Mihail Lomonosov and Georg Rihman **[05]**). Franklin studied the effect with help of a metal wire lifted with help of a kite in the sky.

Benjamin Franklin

January 17, 1706
April 17, 1790

Giovanni Battista Beccaria
1716 - 1781

Another portrait of Benjamin Franklin

Lomonosov and Rihman studied the atmospheric electricity with help of a high raised metal rod, Rihman was killed during the experiments by a lighting. Giovanni Beccaria such metal road firstly connected to the earth , then connected to electroscope and then observed the reaction of the device. So, he could measure the potential of the road compare to ground. Beccaria called the metal road and electroscope “meter of the good weather.”

I tried to repeat Beccaria’s experiment. To my new installed 30- meter length antenna I connected an electroscope. While several minutes potential at the electroscope was raised to 1,500 Volts, then something clicked on my antenna (I believe some insulator sparked) and the electroscope was discharged. It happened periodically.

Electroscope used by Franklin and Beccaria

However, through several weeks I could not catch static at the electroscope. It is obvious antenna insulators catch dirty from the Moscow air and could not keep high static voltage across itself.

Mihail Lomonosov (1711—1765)

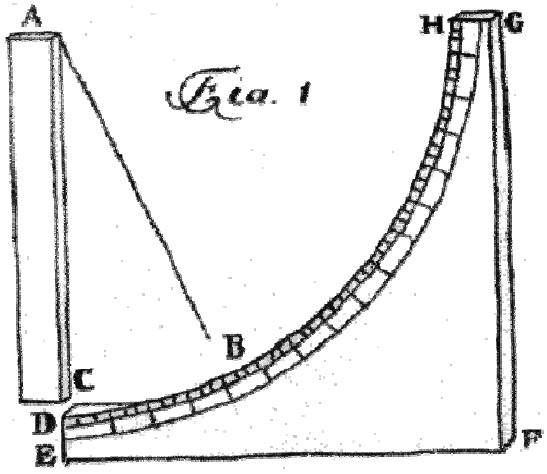
3. Current from the Air

Broom Antenna connected to antenna terminal of old radio as usual has ground potential because almost any old radio has coupling inductor where one end is connected to antenna and other end is connected to the ground. BA is placed near 10-15 meters above the ground where the air has potential compare the ground near + 2,000 Volts. So, from wires of the broom a small ions current is flow. The more wires in the broom, the more current go in to antenna wire. The more space occupancy wires of the antenna the more current go in to the antenna. The more sharpener are ends of wire of the broom, the more current in the antenna.

So, the current in the antenna direct depend from:

1. Numbers of the wire in the broom;
2. Angle between center line and wires;
3. Sharpener of the ends of the wire.

Georg Rihman 1711- 1753



Rihman's Electroscope

A- Wooden Strip
B- Flax Tread
C- Scale

Lots of the all description of the Broom Antenna pointed that the efficiency of the antenna depends from the factors, factors that increase the atmospheric current in the antenna. But how increasing of the current can influence to the reception?

I may suggest the follow hypothesis. Ion current flowing from the broom wires looks like short conductive path. Incoming radio signal may modulate the conductive path. So, atmospheric current going into antenna wire may be modulated by nearby radio signals. Antenna circuit is tuned to desired incoming radio signals, so only wanted radio signals would have maxima strength of the current…

Another suggestion. Ion current flowing from the broom wires may create a column of ions above the antenna. The column may work like an additional antenna connected to the broom, so, it looks like our broom antenna physically making longer by the column of ions.

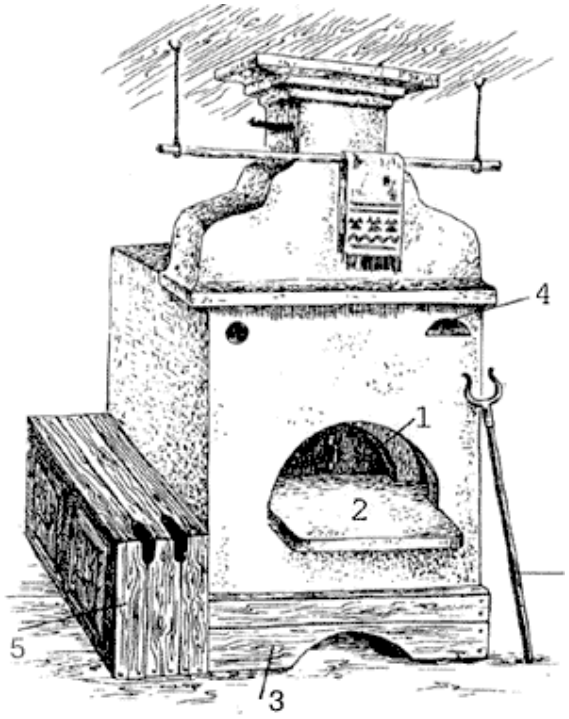
I have read in one old book interesting note. Reception of DX stations coming better at winter windless evening when in the home began light the oven. When I read it I though it is nonsense. How an oven can improve radio reception? But for now I understood that it is not nonsense. Smoke from a chimney goes straight in the sky at windless weather. However the smoke column is a stream of easy-ionized air, so, the column has a little conductivity. Of course, such smoke antenna may improve performance of existing antenna or by re- radiation or adding its height to the existing antenna.

BTW from I.G.: It is really that a Russian Oven may be treated (with some limitations) like an ion generator…

Note by I.G.: At first it was strange to me. Why atmospheric current that flows in the antenna wire can improve the antenna performance? Another puzzle for me: in Russia Broom Antenna has another name – low noise antenna. Lots Russian amateurs handbooks described the antenna like low noise. For example, **[06]** described the antenna like low noise antenna for reception. I had used the antenna in 70s, I could speak that is really low noise antenna that gave good reception. However next chapters of the articles are cleared for me the puzzle.

4. Parameters of Silent and Corona discharge

Lets examine volt/ current parameters of the broom antenna, i.e. how depends discharging current from potential between the air and antennas ends. If we will increase potential between the air and wires of the Broom Antenna the current that flow in the antenna also will increase. It is so called Silent Discharge that going because always there are some quantity of “free” ions in the air. **Figure 3** shows Antenna Current Vs Potential between antenna wires and the air.



Russian Oven- an Ion Generator?

Low Noise Broom Antenna from [06]

The further increasing of the potential between the air and broom wires result to dramatically increasing free ions near the wire the ions can do further ionization of the air near the broom wires and current in the antenna wire increase significant.

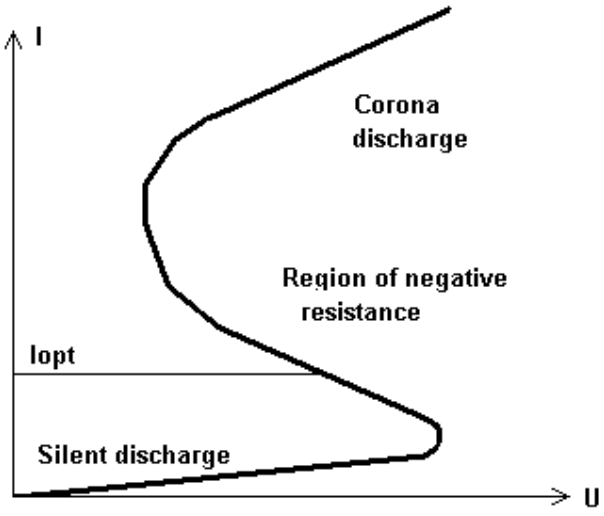


Fig. 3

Figure 3 Antenna Current Vs Potential between antenna wires and the air

Note I. G.: The process about appearance the corona discharge is described above with some simplification. If you print in GOOGLE "corona discharge" and then related phrase, you find hundreds pages containing lots equation… But I leave it to real fun of ***the corona discharge***.

It is may appear wonderful, but at some conditions it is very possible to turn the broom antenna into field having the "negative resistance." Proper height above the ground or proper conditions of the atmosphere may turn the antenna to field of the "negative resistance." In the **Figure 3** it is point ***Iopt***. To keep the antenna in the field of so called "negative resistance" it is need to stabilize current into antenna wire. It is possible to do feeding the antenna through "source of current." However, the atmosphere is an ideal "source of current." So being turn to the field of the "negative resistance" antenna may stay at the conditions quite enough long time…

5. Antenna Amplifier

Part of curve where potential drop but the current is risen is very interesting part of the curve. The part of the curve has so called "negative resistance." Electronic device that has curve with such "negative resistance" may do amplification (of course at some condition). The devices are tunnel diode, neon bulb, thyratron, thyristor. Tunnel diode is used for amplification and generation at VHF- UHF bands. Neon bulb, thyratron, thyristor is used for generation up to hundreds kHz.

Figure 4 shows the simplified schematic of Antenna Amplifier. In to antenna circuit is turn on the Broom Antenna. Current in the antenna circuit at resonance increases in Q times, where Q is Q-factor of the circuit.

Q-factor can be found as reactance of the circuit divided to resistance of losses. When the BA has negative resistance, the resistance compensates the resistance of losses in the antenna. Q-factor of the circuit is increased and RF voltage across the antenna circuit is risen. So, we have increasing in the receiving signals due feeding the antenna by atmospheric electricity.

Certainly, there are lots interesting questions about work of the Broom Antenna. What amplification the antenna may provide? What is the power the antenna gives?

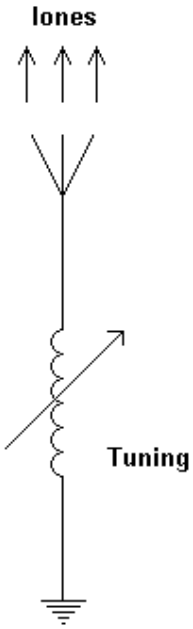


Figure 4 Antenna Amplifier

What is the lower and upper frequencies range of the Broom Antenna?

Be truth, I do not know answer on the questions. The Broom Antenna required more research. I will be grateful for any additional information from those who made such researchers.

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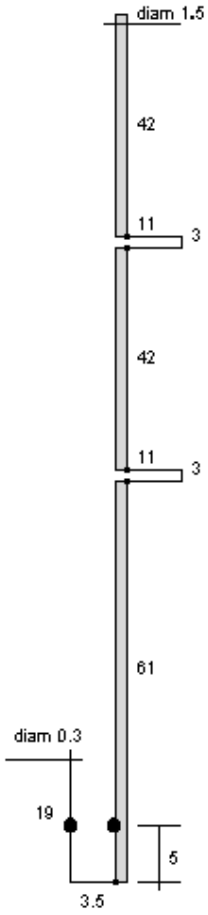
73!

J-Pole Antenna for 433 MHz



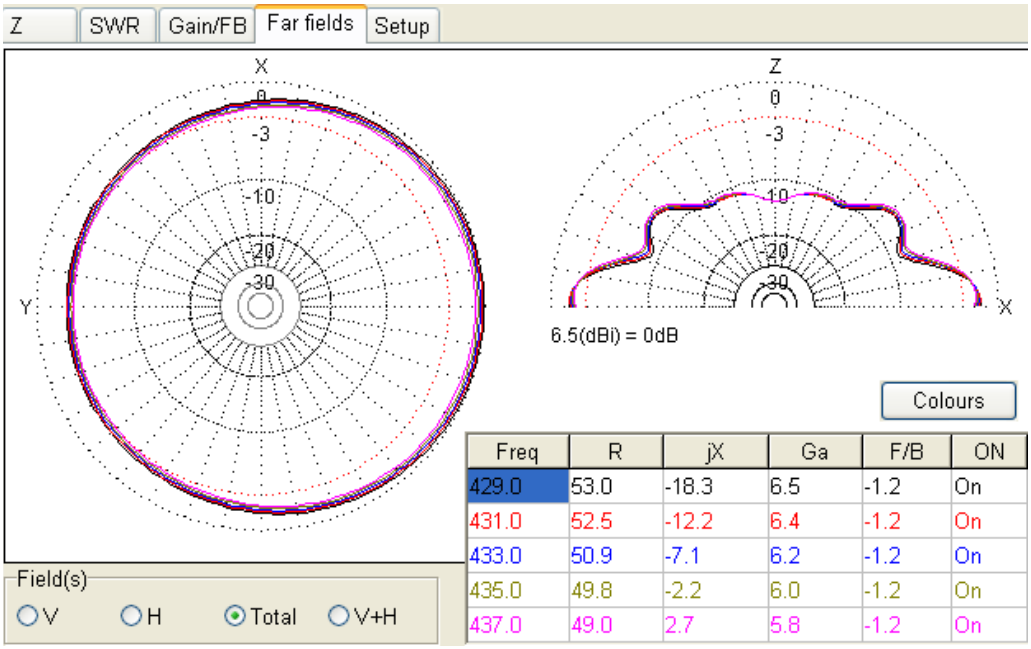
Design by Alexey Kostyuk, EW1LN

EW1LN

J- Pole for 433-MHz. May be made from copper or aluminum stuff. MMANA file is located at http://www.qsl.net/ew1ln/3j58.html.
Sizes in centimeters. ● - ● – feeding points.

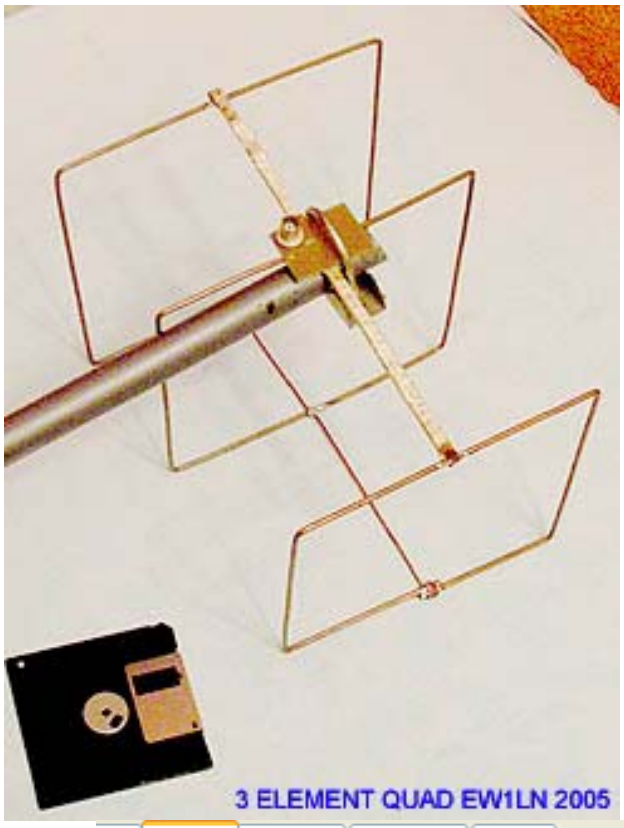
Credit Line: EW1LN, http://www.qsl.net/ew1ln/

73!



Freq	R	jX	Ga	F/B	ON
429.0	53.0	-18.3	6.5	-1.2	On
431.0	52.5	-12.2	6.4	-1.2	On
433.0	50.9	-7.1	6.2	-1.2	On
435.0	49.8	-2.2	6.0	-1.2	On
437.0	49.0	2.7	5.8	-1.2	On

Antenna 'Triplet Quad' for 433 MHz

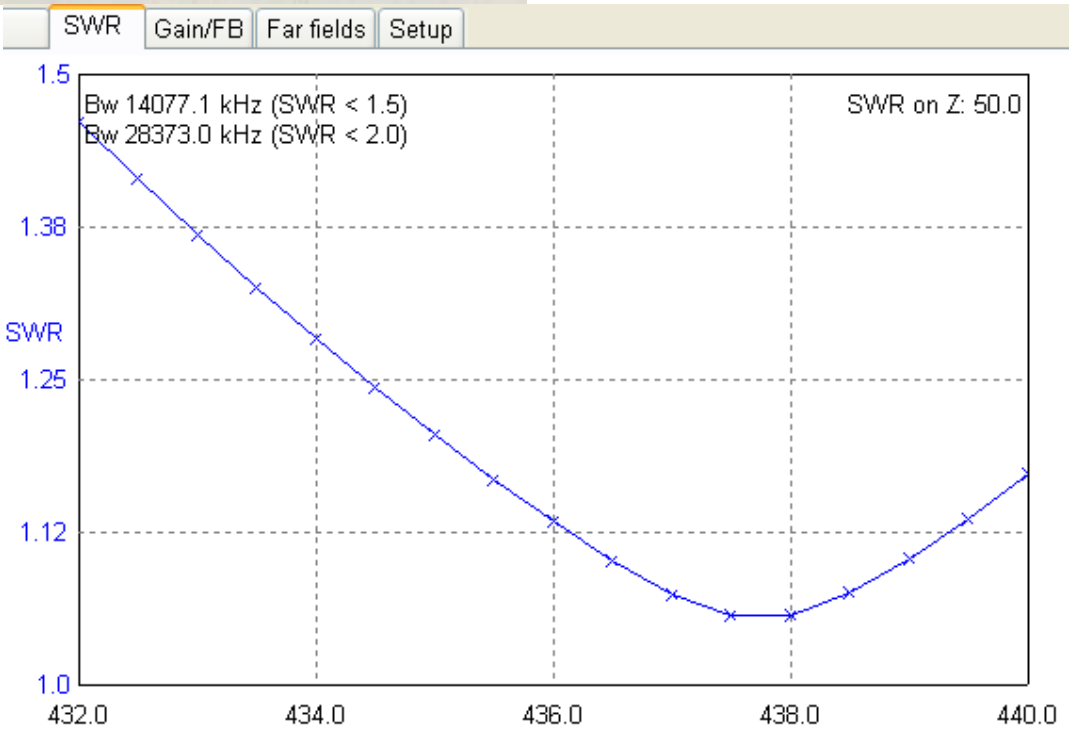


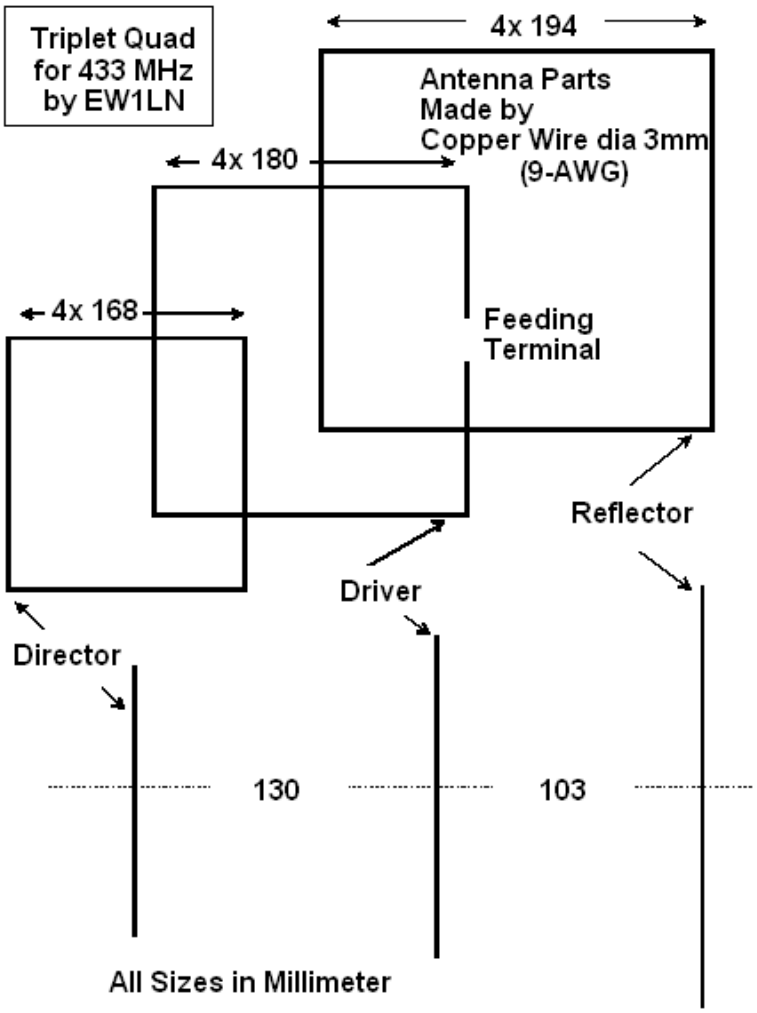
Design by Alexey Kostyuk, EW1LN

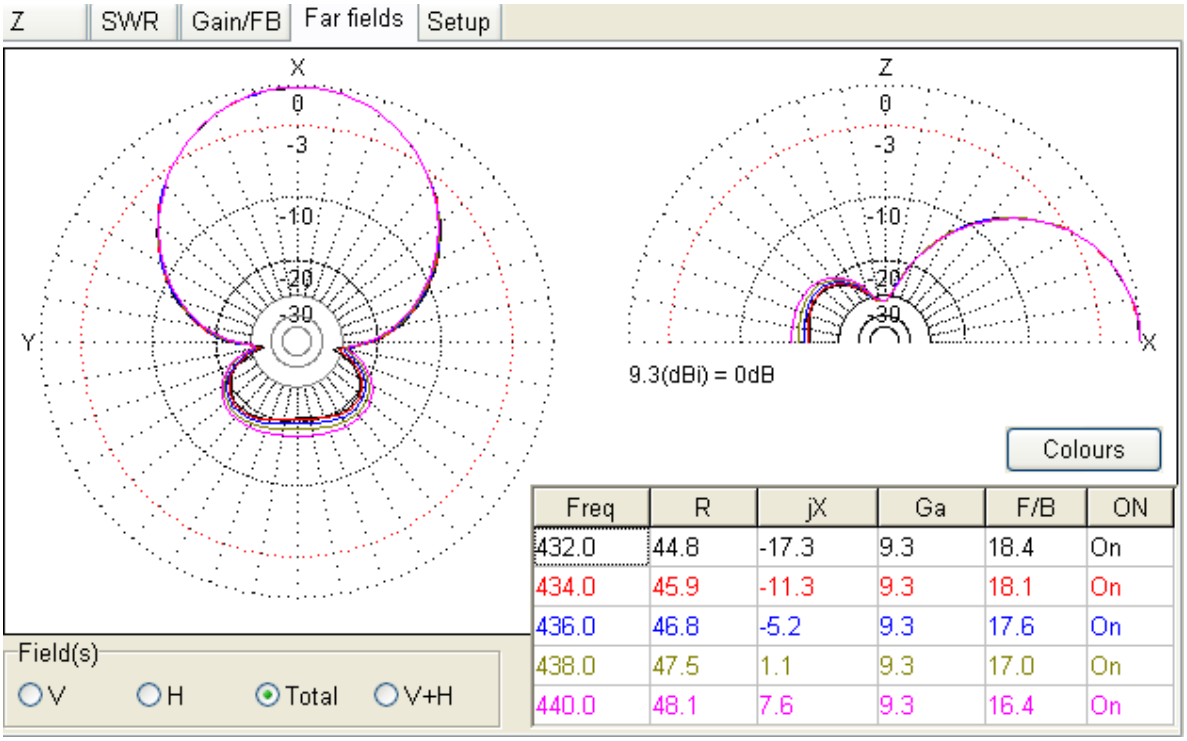
Triplet QUAD Antenna for 433-MHz. May be made from copper or aluminum stuff. MMANA file is located at
http://www.qsl.net/ew1ln/3elq.html.

Credit Line: EW1LN, http://www.qsl.net/ew1ln/

http://www.qsl.net/ew1ln/







Freq	R	jX	Ga	F/B	ON
432.0	44.8	-17.3	9.3	18.4	On
434.0	45.9	-11.3	9.3	18.1	On
436.0	46.8	-5.2	9.3	17.6	On
438.0	47.5	1.1	9.3	17.0	On
440.0	48.1	7.6	9.3	16.4	On

144- MHz Antenna for Satellite Communication

By ex RB5VD

Credit Line:
http://www.cqham.ru/an_144s.htm

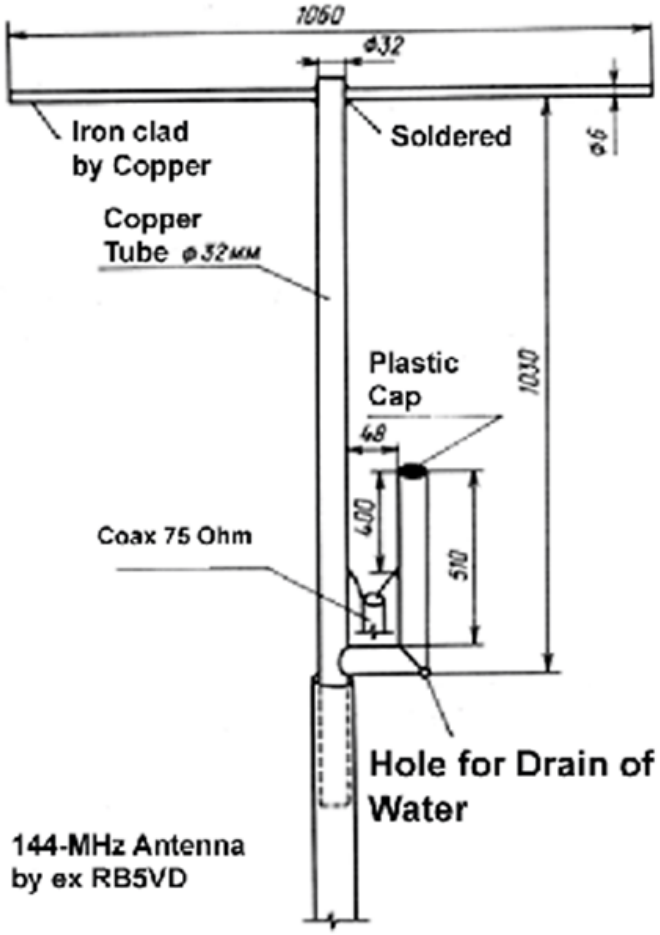


Figure 1 Design 144-MHz Antenna for Amateur Satellite

The simple antenna was tested at satellite communication. Signals from an amateur satellite (when the satellite was in visible sphere) were fine. Also the antenna worked well at local and DX QSOs.

The antenna made from copper tap tubes. Upper horizontal parts may be made from a tube or from a thick bare ware.

Figure 1 shows the design of the antenna. Input impedance of the antenna is 75 Ohm. At 70- 80s some Russian commercial and military VHF transmitters had such output impedance. To change antenna impedance to 50 Ohm just connect coaxial cable a little down from the feedpoint. DD of the antenna is circle in horizontal and eight- shape in vertical plane.

Simple Iambic Key on PIC16F628A

Credit Line:
http://ru3ga.qrz.ru/

Kluyihin Alexandr, RU3GA
ra3ggi@mail.ru

This simple key is assembled with a PIC16F628A. Internal controller's generator on 4-MHz provides function of the PIC. The key can work at feeding voltage from 2 to 5.5-V. Some samples of the PIC16F628A may work when feeding voltage drop ever to 1.2-V. Consumption current at working mode is 2- 4-mA (at supply voltage 5-V) and 0.5- 0.8-mA (at supply voltage 3-V). Consumption current at sleeping mode is less the 1-µA.

So, the key can be fed from a small Lithium battery which may be fed the key (ever without a Power Switch) for several years.

Specification

Iambic mode with memory of last item of data

Iambic manipulator may be reversed with help of buttons

4 memory cells, each one has capacity of 30 letters

Memory cell can be written by PIC's key. Rewriting resource is 1,000.000 times.

Needed corrections in the entering data may be made during the record

Data in the memory cell keep saved without power supply across the PIC

Keying speed could be adjusted (with help of a variable resistor) from 4-WPM up to 100-WPM.

Sidetone is 800-Hz
Sidetone can turn ON/OFF with buttons

Simple hand key may be switched on

Ratio "dot- gap- dash' may be chosen with a multipoint switch:
a) 0.75-1.25-3
b) 1-1-3
c) 1-1-3.5
d) 1-1-4
e) 1-1-4.5

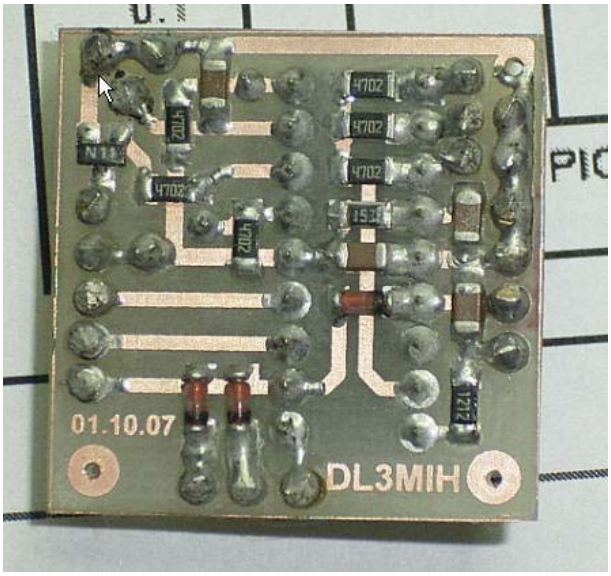
Operation

● *Record to a memory cell*

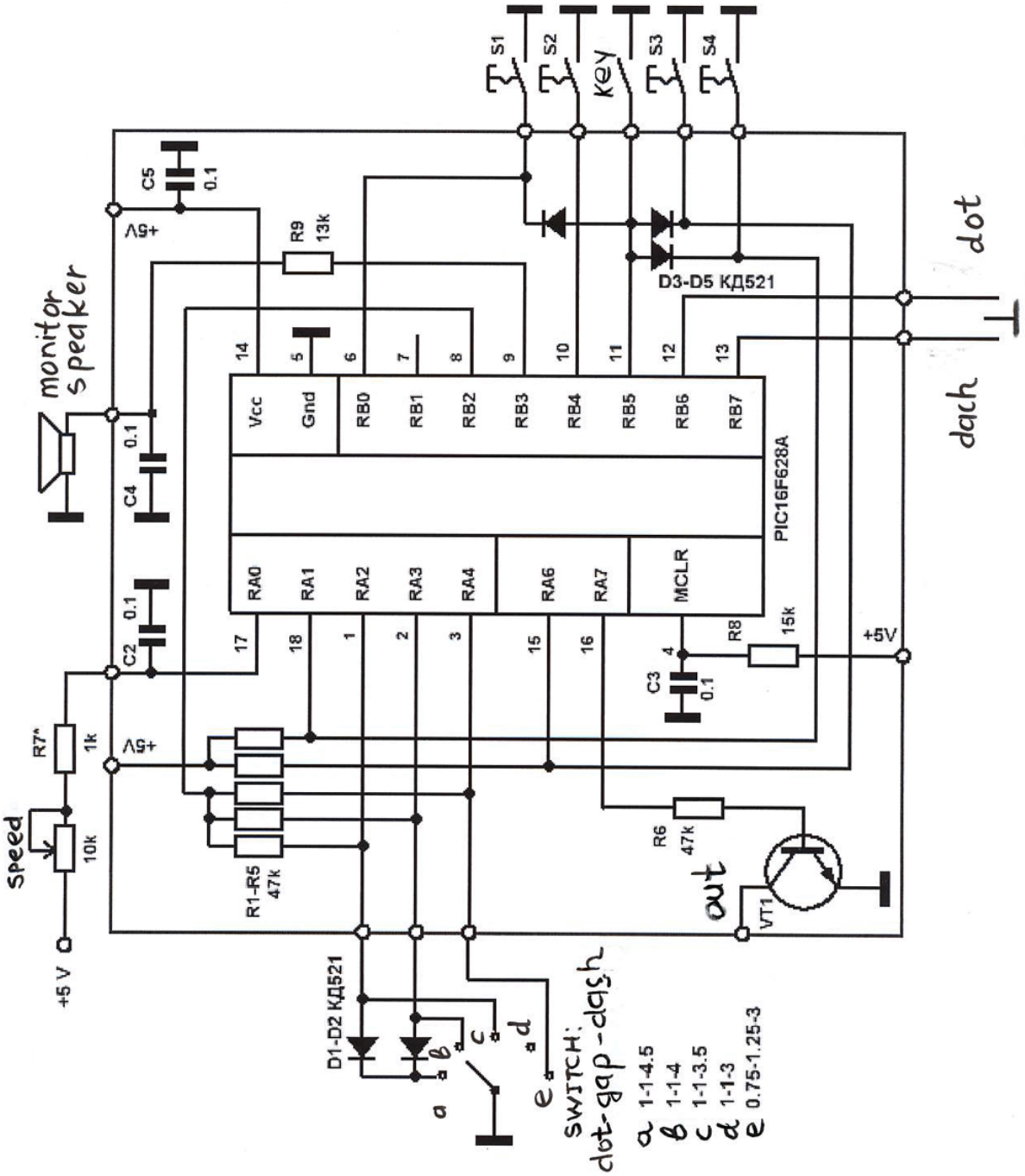
Hold button of needed memory cell for 2 seconds. Speaker transmits "WR" – it means that key stands for the record. At a record the gap between letters the key recognizes automatically. For installation a gap between words you need to do pause in the record for 2 seconds. Speaker transmits "R" – it means that the key is "understood" the gap between words and key is waiting for the record of next data. So, before enter of new data you may drink a coffee or read a book. Key will wait you for the record. When only 3 letters are to finish the memory cell the Sidetone is changed in frequency. To terminate the record tap any button.

● *Correction of Data*

If an erroneous symbol was entered do transmitting dots in number more than six. Speaker will transmit "R"- it means that key stands in "Correction Mode." After that speaker transmit "Last" + "last right letter" and go to Waiting Mode. Speaker transmits "Last NO" if an error was on the first record letter.



PCB for the Key by DL3MIH



http://ru3ga.qrz.ru/

Example: Should be necessary to record “CQ DE RU3GA.” However it was recorded “CQ DI.” To fix the error we transmit series of dots, Speaker transmits “R,” then “Last D,” after that key turns to a Waiting Mode, enter “E RU3GA,” tap any button, that is all. However, it is possible correct any letter. See example below.

Example: Should be necessary to record “CQ DE RU3GA.” However, it was entered “CQ NI.” To fix the error we transmit series of dots, Speaker transmits “R,” then “Last N,” after that key turns to a Waiting Mode, again we transmit series of dots, Speaker transmits “R,” then “Last Q,” after that key turns to a Waiting Mode…. Enter “DE RU3GA” then tap any button.

● *Play Data from a Memory Cell*

Tap a button of the appropriate Memory Cell

● *Stop Play Data from a Memory Cell*

Click by any paddle of the Iambic manipulator or tap a hand key

● *Sidetone OFF/ON*

1. Push and hold Button 1, then push Button 2, Hold both Button while 4 seconds. Speaker transmits “OFF’- Sidetone is Off.
2.To turn Sidetone On repeat 1.
The option is recorded in memory. After OFF/ON key would stay in mode that was before Off.

● *Tune Mode*

Push and hold Button 1, then push Button 3, Hold both Button while 4 seconds. Go off from Tune Mode- tap any button or click by manipulator.

● *Reverse Iambic Paddle*

1. Push and hold Button 1, then push Button 4, Hold both Button while 4 seconds. Speaker transmits “REV’- manipulators paddle for “Dot” and “Dash” will be reversed. The option is recorded in memory. After OFF/ON key would stay in mode that was before Off.

Design

Depends on your needs the key may be built up in a transceiver or used as a separate project. Sidetone’s Out may be switched on the transceiver speaker. Switch for interval “Dot- gap- Dash’ may not be installed. In this case you are reached the ratio “1-1-3.” However, R1-R3 must be installed.

The key was tested me, however, some errors and glitch in the program are possible. So, you feedback are welcome! Mail to: ra3ggi@mail.ru

Last Hex may be loaded (September 6, 2007):
http://ru3ga.qrz.ru/UZLY/key.shtml

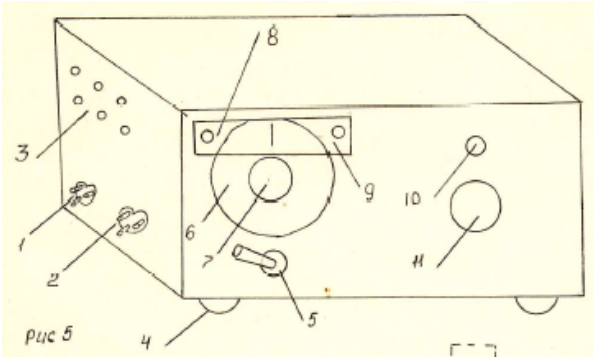
73! From RU3GA

SHACK + WORKBENCH RU3GA

Tube-Semiconductor- Transceiver (TST)

Transceiver TST was published in my book- “QRP Transceivers and PAs from Accessible Parts “
The book was published by me (on my own expenses) in 1991, in Belgorod, Russia. I had printed 2000 samples of the book. The book describes kits which my own company (“Vibrissa”) produced at the times. Fist such kit was transceiver TST. Were produced 400 kits of TST (Tube- Semi- conductor- Transceiver) near 50 of them were assembled by me for customers. Of course, may be some design of the transceiver seems to be old for the days, but what I can say, the transceiver works, and works not bad.

72/73! I.G.



Transceiver TST

Tube- Semiconductor- Transceiver (TST)

The transceiver consists of from two parts: there are RX part and TX part. Let’s see how it is worked beginning from the TX part.

TX

Figure 1 shows the circuit of the tube’s part of the transceiver TST.
VFO made on tube V1 (grid- cathode part). Zener diode VD1 (100V/ 20mA) provides the stable voltage to the tube. V1 works not only as VFO. L2C5 (switched in anode circuit) doubles the VFO frequency that depends on L1C2. Driver is assembled on V2, PA made on V3.

In my case the VFO worked very stable when Russian tube 6J2P was used in it. However, at 160- 20 meters pentode 6J1P works not bad. Inductor L1 is coiled on Russian resistor MLT-2 or WS-2 (it is depends on used band). The coil is uniformly spread on the form. The inductor should be coiled by wire that provides coiling turn to turn. To provide stability of the VFO the inductor coiled on the form firstly coated with neutral glue. I used Russian glue BF-2. Wire of the inductor is coiled (above the glue) with a small tension. After coiling the glued inductor is dried at + 150 C- degree while 2 hours. After that the inductor one more time is coated with the glue. After that the inductor is dried at room temperature for 24 hours. Remember, from the quality of the L1 depends the frequency stability of the TST. I had reached at 10- meters band the drift 200 HZ/hour with my home made inductors (and proper C2,C3).

Of course, if you managed use a ready- made inductor from an old VFO- use it. Tap to cathode goes from ¼ from the “cold end.” (At my kit a special ceramic form for L1 was included)

If you can not get good air- dielectric Cn for the VFO - use a variable resistor that is switched on as the **Figure 2** shows. Resistor may have whole resistance in 1… 3-k. Tap to the resistor is taken from middle of the inductor. C* (27- 100-pF) is required picking to desire frequency range. The schematic provides less stability compare to air- variable capacitor. However, it is very possible to get a good stability just picking the capacitors (around L1) having different Temperature Coefficient of Capacity.

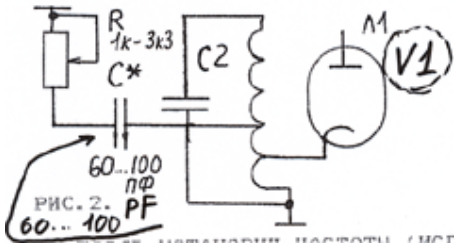
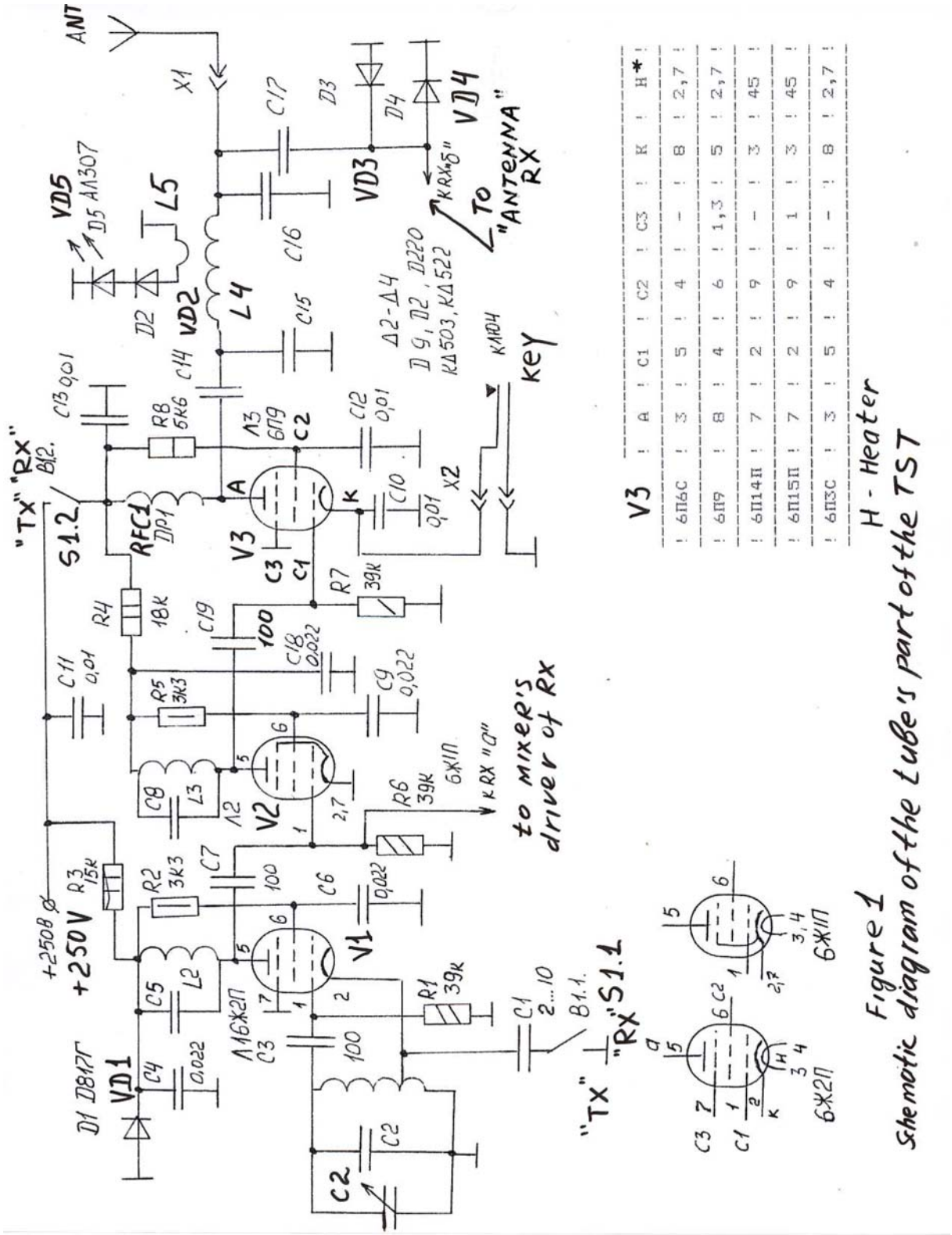


Figure 2 Variable Resistor instead Variable Capacitor

Adjusting and Tuning VFO

At first tune the tank L1C2 (with help a receiver or digital frequency meter) to needed frequency. Do not forget that the circuit is tuned to ½ or 1/3 frequency from used one. Then tune receiver to used frequency and tune L2C5 to maximum strength of the signal. Of course, you may use an RF voltmeter to do it. Then tune L3C8.



V3	A	C1	C2	C3	K	H*
6П6С	3	5	4	–	8	2,7
6П9	8	4	6	1,3	5	2,7
6П14П	7	2	9	–	3	45
6П15П	7	2	9	1	3	45
6П3С	3	5	4	–	8	2,7

Figure 1
Schematic diagram of the tube's part of the TST

It is possible to do in two different ways. First, use a receiver and tune to maximum strength. Second, turn on an amperemeter between R4 and C18 and tune to minimum current. Current at resonance L3C8 fall but voltage across resistor R7 (it is measured by a high-ohms voltmeter, preferably electromechanical (not digital) is raised.

Note: V3 at the measurement the voltage across R7 should be in the socket, heater turn on but the voltage from anode and grid- 2 should be removed.

After the final tuning L3C8 turn on anode voltage to V3, turn on an antenna to X1, and tune the PA (with help of C15, C16) to maximum power going in to the antenna.

LED VD1 shows the power, the brighter it glows the more power is going in to the antenna. Coupling loop L5 should be placed at proper distance at L4, LED should not glow too bright that may cause fault for this one. As usual the circuit (L4,C15,C16) is being tuned at the center of an amateur band does not require to be retuning to the edges of the band. So, if only one antenna (or several antennas having the same input impedance, for example 50 Ohms) is used, it is possible use fixed capacitors C15, C16. At the PA a Russian tube 6P3S, 6P6S, 6P14P, 6P9, 6P15P works well. First three work well at 160 through 20 meters, the last two work well at 20- 10 meters. **Table 1** shows data for all inductors of the TX.

Table 1 Data for inductors of the TX

ТАБЛИЦА 1
ДАННЫЕ КОНТУРОВ ТХ

ДИА- ПАЗОН	1,8	3,5	7	10	14	18	21	24	28	
L1 *	-	-	28	18	15	13	14	11	11	МЛТ-2
	120/30	70/20	-	-	-	-	-	-	-	ВС-2
C2	1000	800	600	600	500	400	300	300	200	***
L2 *	-	-	25	19	15	14	11	10	10	МЛТ-2
	120/20	60/20	-	-	-	-	-	-	-	ВС-2
C5	200	200	180	150	120	100	100	90	60	
L3 *	-	-	25	19	15	14	11	10	10	МЛТ-2
	120/20	60/20	-	-	-	-	-	-	-	ВС-2
C8	200	200	180	150	120	100	100	90	60	
L4 *	53/45	27/45	14/40	10/45	8/45	7/45	7/45	6/45	6/45	**
C15	150	150	120	120	100	80	80	50	30	
C16	2000	2000	1500	1200	1000	600	600	500	300	
C14	1500	1000	1000	1000	470	470	390	300	300	

* First column- numbers of turns, second column- length of winding. Otherwise inductor is winded uniformly on to the form.

** Inductor L4 is coiled on a form in diameter 34 millimeter. For 160- 80 meters use wire 0.8 mm (20 AWG), for 40- 20 meters use wire in 1.0 mm (18 AWG), for 17- 10 meters use wire 1.0… 2.0 mm (18- 12 AWG).

diameter 0.1- 0.2 mm (37- 32 AWG), for 40- 30 meters may be wound by wire in 0.25- 0.5 mm (30- 24 AWG), for 20- 10 meters may be wound by wire in diameter 0.5- 0.8 mm (24- 20 AWG).

*** L1, L2, L3 are coiled on Russian resistors WS2 or MLT-2. Resistance for these ones should be more then100-k for L1 and L2. For inductor L3 the resistance should be more the 27-k.
L1 for 160- 80 meters may be wound by wire in

Note: Capacitors C1 and C5 may need be chosen to your implementation of the L1 and L2. Use a variable capacitor with a big marked limb to determinate the value of C1 and C5. Then install a fixed capacitor instead the variable.

L2 for 160- 80 meters may be wound by wire in diameter 0.1- 0.2 mm (37- 32 AWG), for 40- 30 meters may be wound by wire in diameter 0.25- 0.5 mm (30- 24 AWG), for 20- 10 meters may be wound by wire in diameter 0. 5- 0.8 mm (24- 20 AWG)

L3 for 160- 80 meters may be wound by wire in diameter 0.1- 0.2 mm (37- 32 AWG), for 40- 30 meters may be wound by wire in diameter 0.25- 0.5 mm (30- 24 AWG), for 20- 10 meters may be wound by wire in diameter 0.5- 0.8 mm (24- 20 AWG)

When TX is assembled and tuned, it is possible try to do QSOs using this one and separate receiver. At this case increase the capacity of the shift – frequency

capacitor C1 to 100… 300-pF.It makes the shift of the VFO frequency far away from the amateur band. Solder the C1 to another end of the S1.1 (compare to shown in **Figure 1**) to shift the frequency in the low edge of the frequency band.

Note: Do not stay V3 at high voltage when the VFO or/and driver does not work properly. V3 gets the grid bias voltage from detecting an RF by the part- "1-grid- cathode." Without bias voltage (the same without an RF on the first grid) the tube may overheated (due huge anode current) and goe off operation. After tuning TX tune the RX part.

Part List TX

Tubes:

V1: Russian Tube 6J2P- small RF Pentode with short characteristic

V2: Russian Tube 6J1P- small RF Pentode with short characteristic

V3: Russian Tube 6P15P- RF Power Pentode

Resistors:

R1: 39 k/ 0.25 W* (27- 100 k)
R2: 3.3 k/ 0.5 W* (680 Ω – 5.6 k)
R3: 15 k/ 2 W* (12 – 18 k)
R4: 18 k/ 2 W* (12- 24 k)
R5: 3.3 k/ 0.5 W* ((680 Ω – 5.6 k)
R6: 39 k/ 0.25 W* (27- 68 k)
R7: 39 k/ 0.25 W* (27- 51 k)
R8: 5.6 k / 1 W* (3.3- 6.8 k)

*Recommended
() In brackets- may be used

Capacitors:

C1: 2… 10 pF*
C2: See Table 1
C3:100 pF**
C4: 0.022 uF***
C5: ***See Table 1***
C6: 0.022 uF***
C7: 100 pF**
C8: See Table 1
C9: 0.022 uF***
C10: 0.01 uF***
C11: 0.01 uF***
C12: 0.01 uF***
C13: 0.01 uF***
C14: See Table 1
C15: See Table 1
C16: See Table 1
C17: 27 pF**
C18: 0.022 uF ***
C19: 100 pF**
Cn: 10- 50 pF****

* Depend on frequency shift
** Tolerance +100- 30%
*** Tolerance +200- 30 %
**** Depend on used band

Diodes

VD1: Zener Diode, 100 V/20 mA, should be placed on a small heater sink, I had used a coin having dimension of a 25 cents US coin.
VD2: Any small power RF diode
VD3: Any LED
VD4: Any small power RF diode
VD5: Any small power RF diode

Switches:

S1: Any DPDT switch that can be used at 250 V/ 100 mA

Connectors:

X1: Any RF Connector
X2: 5- PIN Audio Connector

RF- Choke:

RFC1: Wound on Russian Resistor WS-2 (sizes: diameter 9.7-mm, length 49-mm), resistance more than 51-k. ***Figure 3*** shows the RFC implemented for different bands.

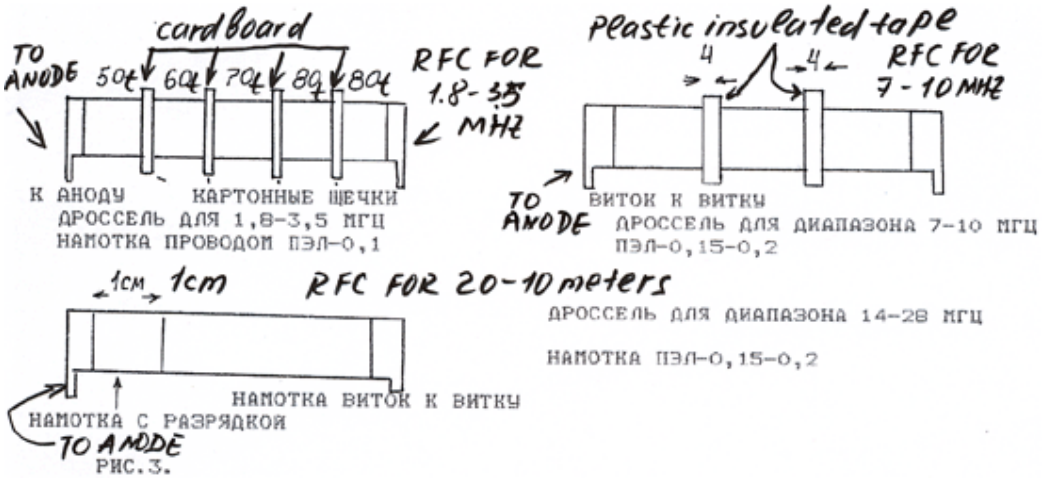


Figure 3. RFC for TST

A) 180- 80 meters: 50+60+70+80+80 turns by insulated wire 0.1-mm (38-AWG);
B) 40- 30 meters: 3 section wound turn to turn by insulated wire 0.2- mm (32- AWG);
C) 20- 10 meters: 1 section is wound with step 0.3 – mm, second section wound turn to turn by insulated wire 0.2-mm (32-AWG).

RX

A DC receiver is used at the TST. **Figure 4** shows schematic of the receiver.

Figure 4. Circuit diagram for DC receiver of the TST

RF Amplifier: It has active component T1 and T2. VD1… VD4 are protected the input RF Amplifier from an overload by own transmitter or power signals coming from the Air. The diodes allow use for the transceiver a separately antenna (sometimes it allows to avoid AC hum in the head phones). Adjusting the RF Amplifier is simple. With help of R3 install at emitter of T2 half voltage compare to collector T2. Check current of T2. It should be 5- 10-mA. If the current is higher – increase R1 then check again voltage at emitter T2. If the current is lower, decrease the R1, then again check voltage at emitter T2. L1C1 and L2C5 should be tuned on working frequency.

Driver for VFO: It is made on T3. Check drain current when signal from VFO is applied to the gate of the T3. It should be not more then 15-mA. If the current is more, play with R5 and C6. It is useful to play with R5 and C6 on to best reception.

RF Amplifier and Driver for low- bands: At 160- 40 meters you may use simplified RF amplifier made on 1 transistor and driver made on usual bipolar transistor. However, at such design the AC hum may come to head-phones.It may come difficulties with adjusting the driver to obtain an optimal RF voltage at mixer. Frequency between TX and RX may drift. **Figure 5** shows the schematic for simplified RF Amplifier (A) and Driver (B).

Quasi- Balanced Mixer: It is made on diodes VD5… VD9. RF is coming through L2.2 to the mixer. R6, R7 and C7, C8 provide quasi - balancing. No tuning and adjusting at right parts.

Audio Filter: It is made on C9, R8 and C10. Cutting frequency is near 3.5-kHz. If you have a commercial made Audio Filter (for example, from an old TRX) – use it. Turn on this one instead R8, C10 may be deleted. It is possible turn on instead R8 an old Universal Magnetic Head (from an old tape recorder), however, in some case an AC hum may come. No tuning and adjusting at right parts.

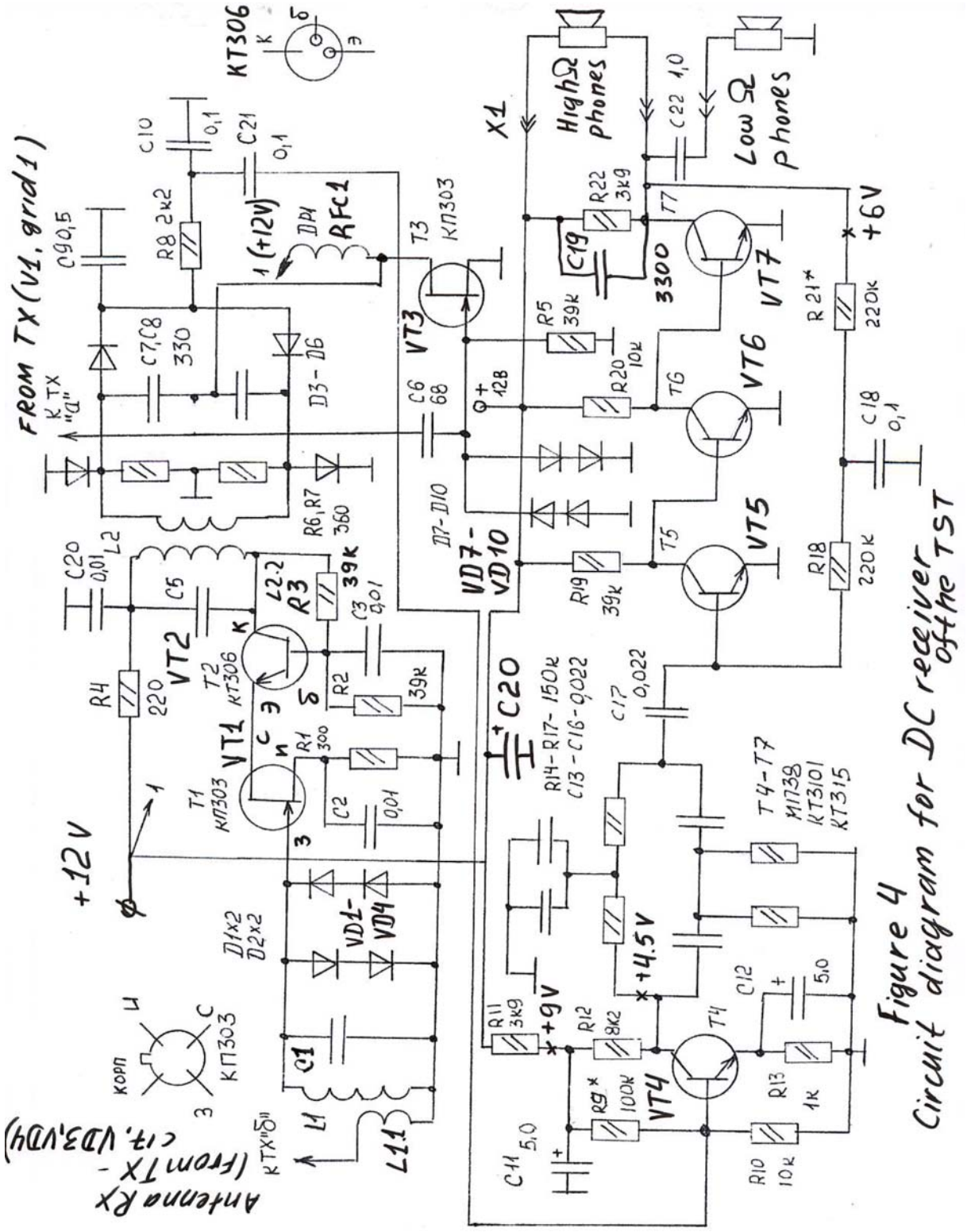


Figure 4
Circuit diagram for DC receiver of the TST

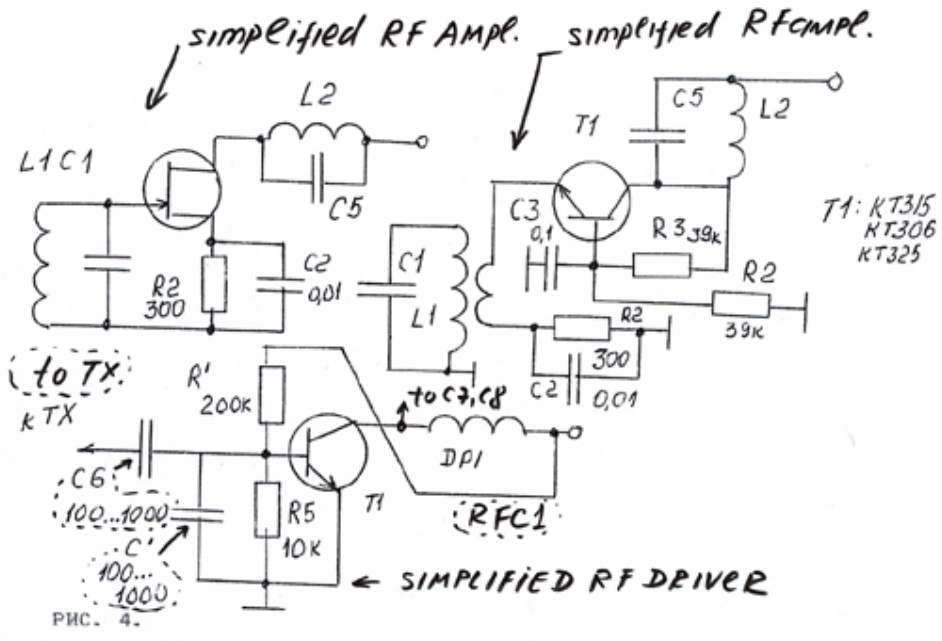


Figure 5 Circuit diagram for simplified RF Amplifier **(A)** and Driver **(B)**

Audio Amplifier: It is made on T4, T5, T6, T7. It is preferable to use a low noise high – gain transistors. It may be any low power old- made germanium or modern silicon transistors. Adjusting is a very easy. With help of R9 install at collector T4 the voltage 4.5-V. With help of R21 install at collector T4 the voltage 6.0-V. If audio amplifier has self-excitation, increase R11 (for example to 6.8-k or more).

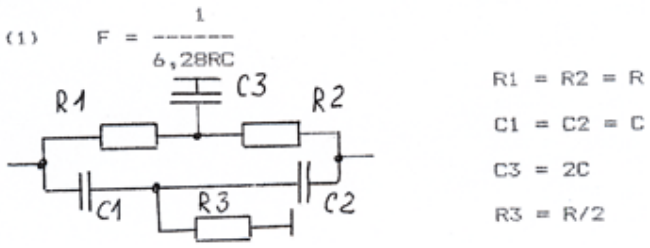


Figure 6 Bridge Wien

Bridge Wien: Bridge Wien (detailed shown on **Figure 6**) does rejection of the 50-Hz. The frequency is used at AC in Europe. It is possible re-count (using equation from the **Figure 6**) both as rejection frequency as parts for the bridge. Parts should have as possible small tolerance as can.

It is possible to use a precision potentiometer instead R3 (on **Figure 6**) to adjust the rejection frequency.

Figure 7 shows PCB (from side of the foil). PCB has sizes 100 x 70 mm. **Figure 8** shows view to montage of the RX. Board made by through- hole montage.

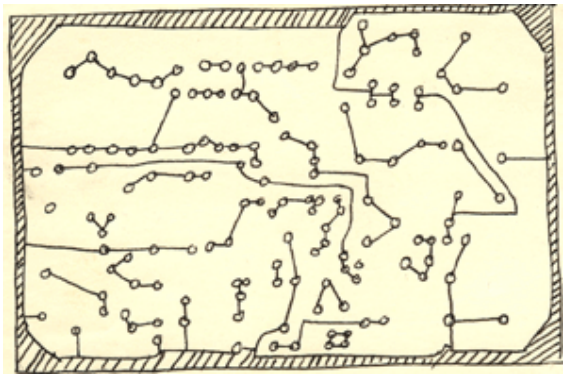


Figure 7 PCB of the RX

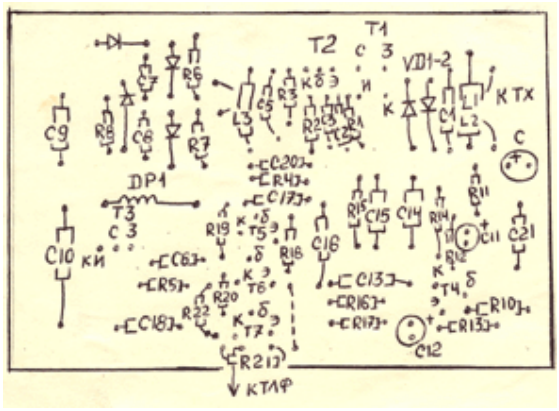


Figure 8 Montage of the RX
(Arrow shows to “Phones”)

Part List RX

Resistors:

R1: 300/0.25 W*
R2: 39 k/ 0.25 W*
R3: 39k/ 0.25 W*
R4: 220 /0.25 W* (200- 1000 Ω)
R5: 39k/0.25 W*
R6: 360/0.25 W* (470- 1000 Ω)
R7: 360/ 0.25 W* (470- 1000 Ω)
R8: 2.2k/0.25 W* (1k- 3.9k)
R9: 100k/0.25 W*
R10: 10k/0.25 W* (5.6k- 10k)
R11: 3.9k/0.25 W*
R12: 8.2k/ 0.25 W* (5.1k- 10k)
R13: 1k/0.25 W*
R14: 150k/0.25 W**
R15: 150k/0.25 W**
R16: 150k/0.25 W**
R17: 150k/0.25 W**
R18:220k/0.25 W* (39k- 300k)
R19: 39k/0.25 W*(27k- 51k)
R21: 10k/0.25 W* (8.2k- 12k)
R22: 3.9k/0.25 W* (3.9k- 6.8k)

*Recommended
** Tolerance 2%
() In brackets- may be used
R6 must be similar to R7

Capacitors:

C1: ***See Table 2***
C2: 0.01 uF*
C3: 0.01 uF*
C4: 68 pF
C5: ***See Table 2***
C6: 68 pF
C7: ***See Table 2***
C8: ***See Table 2***
C9: 0.5 uF
C10: 0.1 uF
C11: 5.0 uF**
C12: 5.0 uF**
C13: 0.022 uF***
C14: 0.022 uF***
C15: 0.022 uF***
C16: 0.022 uF***
C17: 0.022 uF***
C18: 0.1 uF *
C19: 3300 pF*
C20: 50.0 uFf**
C21: 0.1 uF *
C22: 1.0 uF *

* Tolerance +200- 30%
** Electrolytic
*** Tolerance 5%
C7 must be similar to C8

Diodes

VD1- VD10: Any small power RF diodes
VD5- VD8 must be similar

Connectors:

X1: 5- PIN Audio Connector

RF- Choke:

RFC1: Wound bulky by insulated wire 0.1-mm (38-AWG) on Russian Resistor WS- 0.5 (sizes: diameter 5.5-mm, length 26-mm), resistance more than 51-k. For quantity of turns see **Table 2.**

Semiconductors

VT1: Small power N- channel RF FET
VT2: Small power NPN bipolar RF transistor
VT3: Small power N- channel RF FET
VT4: Low noise high- gain PNP audio transistor
VT5: Low noise high- gain PNP audio transistor
VT6: Low noise high- gain PNP audio transistor
VT7: Low noise high- gain PNP audio transistor

Table 2. Data for inductors for the receiver

ТАБЛИЦА 2
ДАННЫЕ КОНТУРОВ RX

ДИА- ПАЗОН	1,8	3,5	7	10	14	18	21	24	28		
L1,L2	68	38	22	17	17	17	17	17	17	*	
C1,C5	360	300	270	240	120	100	91	51	30		
C7,C8	1000	680	510	390	330	240	200	120	100	**	
ДР1	300	250	200	180	120	120	120	80	80	***	

* Inductors for 160- 80 meters is wound bulky by insulated wire 0.1-mm (38-AWG) on Russian Resistor MLT- 2 (sizes: diameter 8.6-mm, length 18.5-mm), resistance more than 51-k. For others bands (40- 10 meters) the inductors are wound uniformly by insulated wire 0. 5-mm (25-AWG) on Russian Resistor MLT- 1 (sizes: diameter 6.6-mm, length 13-mm), resistance more than 51-k.

** C7 and C8 may have tolerance -60 +100%, however, C7 must be similar to C8

*** RFC1: Wound bulky by insulated wire 0.1-mm (38-AWG) on Russian Resistor WS- 0.5 (sizes: diameter 5.5-mm, length 26-mm), resistance more than 51-k.
Figure 3. RFC for TST

Note: Capacitors C1 and C5 may need be chosen to your implementation of the L1 and L2. Use a variable capacitor with big marked limb to determinate the value of C1 and C5. Then install a fixed capacitor instead the variable.

Design TST

Experience shows that design in DC transceiver plays the same role as the schematic does. Perform the transceiver strictly to the draft and you obtain good result. **Figure 9** shows design of the TST.

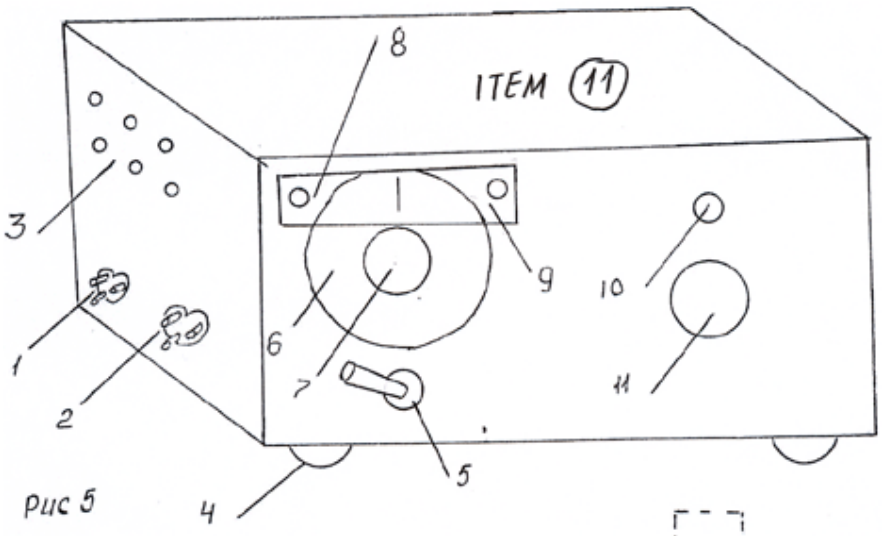


Figure 9 Design of the TST

According to **Figure 9**:

1. Connector + 250/+12/ AC 6.3V
2. Key
3. Ventilating holes
4. Stipes (may be made from a cap of toothpaste)
5. Toggle - Switch TX-RX
6. Tuning Dial, made from a PCB stuff
7. Tuning Knob (may be made from a cap from a plastic can), glued by “Crazy Glue” to item 6
8. Wide Strap (made from transparent Plexiglas)
9. Support Pole
10. LED TX
11. Tuning PA

Figure 10 shows the view upside to the montage of the TST. Montage must be done strictly to the figure.

Figure 11 shows view to inside of the TST. Drafts with sizes (in millimeter) for items 1- 11 are shown below. Leads of the TX’s parts are soldered to pad (the pad dimension on 4x4 mm are cutting on the PCB at parts position). L4 made from a heavy wire (for 20- 10 meters) may be just soldered by its leads to X1 and C15. L4 for 160- 30 meters wound on a form (plastic or cardboard) may be fastened to item 8. Holes intended the Tube Plastic Socket have sizes a bit less the sockets. So the sockets are hard inserted to the holes then grounding leads soldered to PCB.

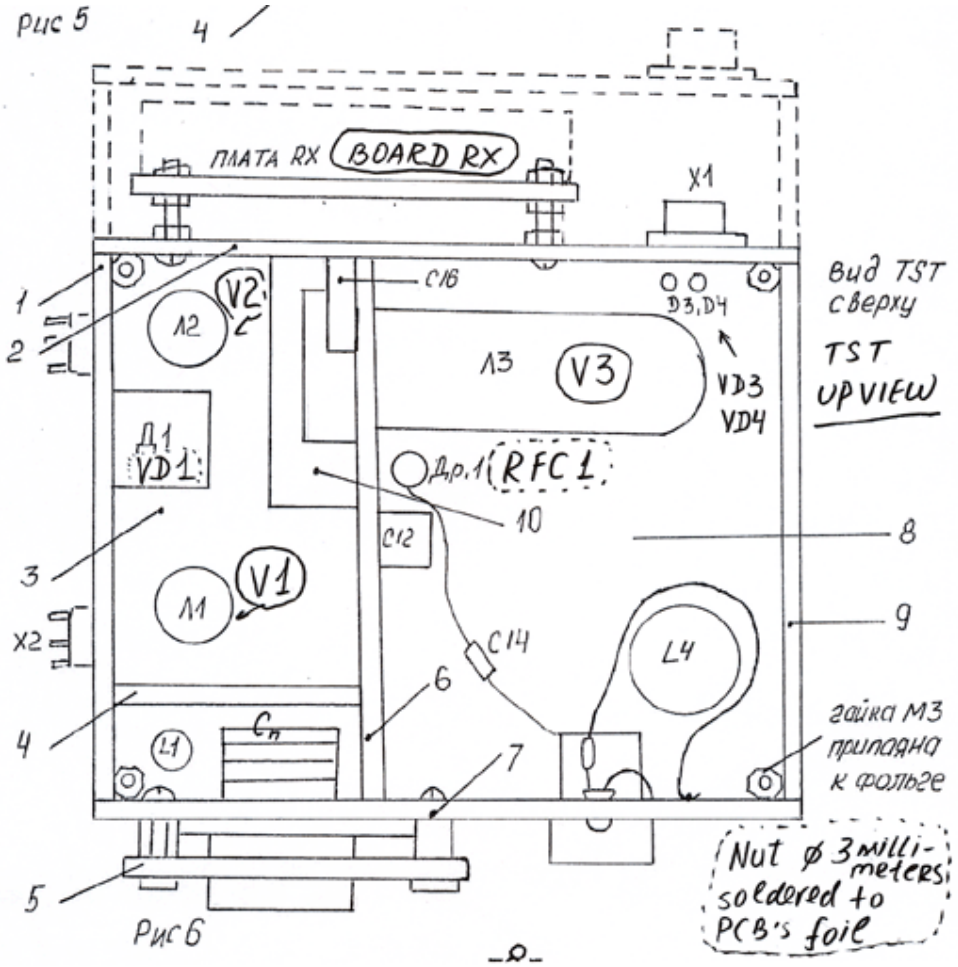


Figure 10. View upside to the montage of the TST

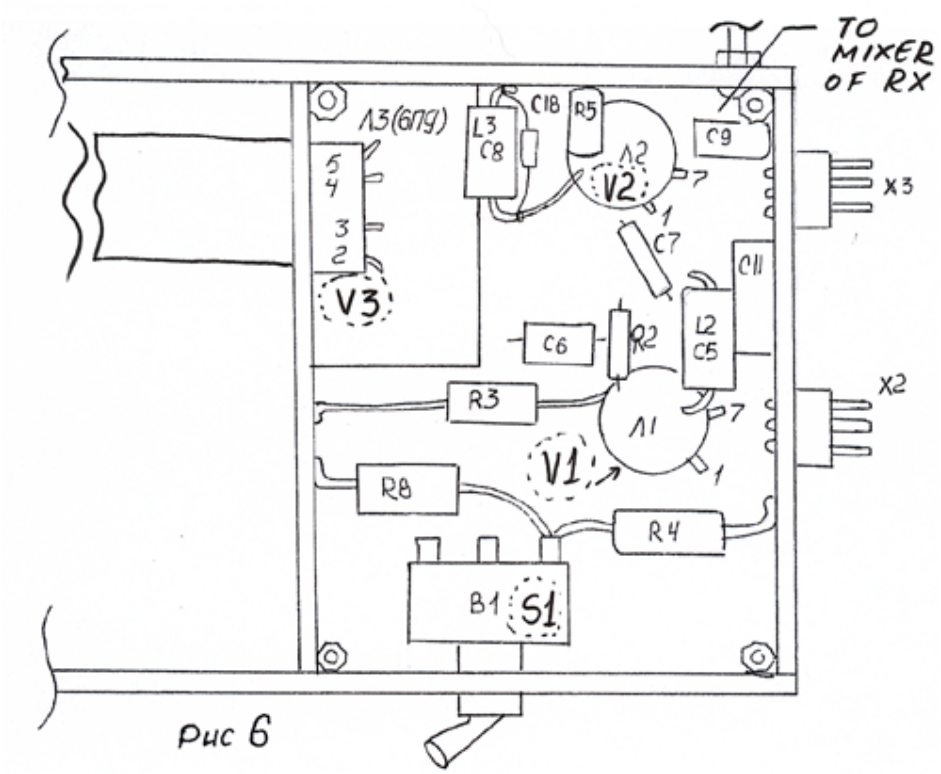
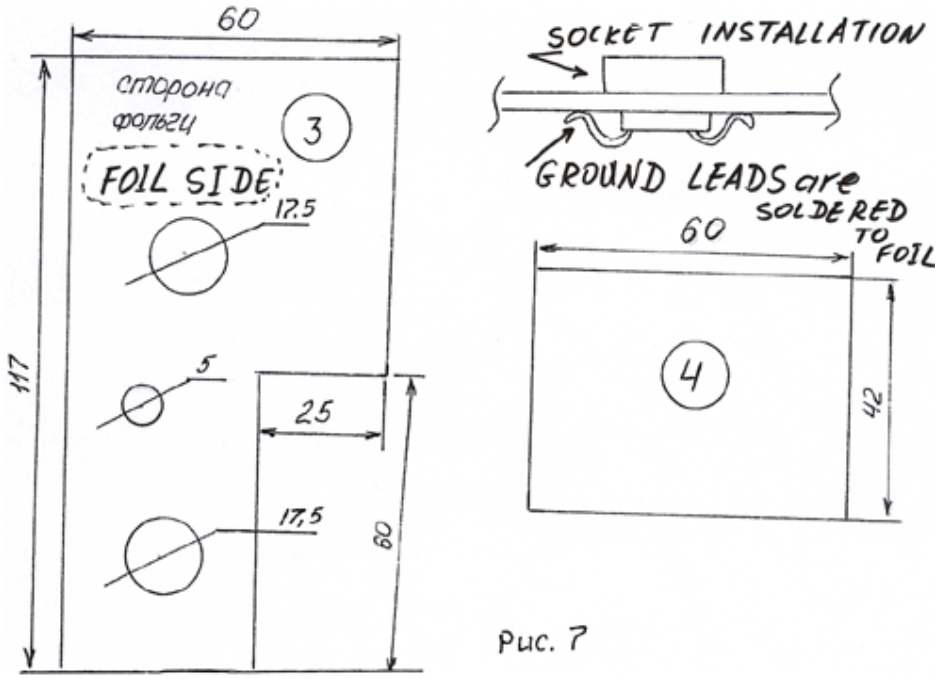


Figure 11. View inside of the TST

Steps to assembling TST:

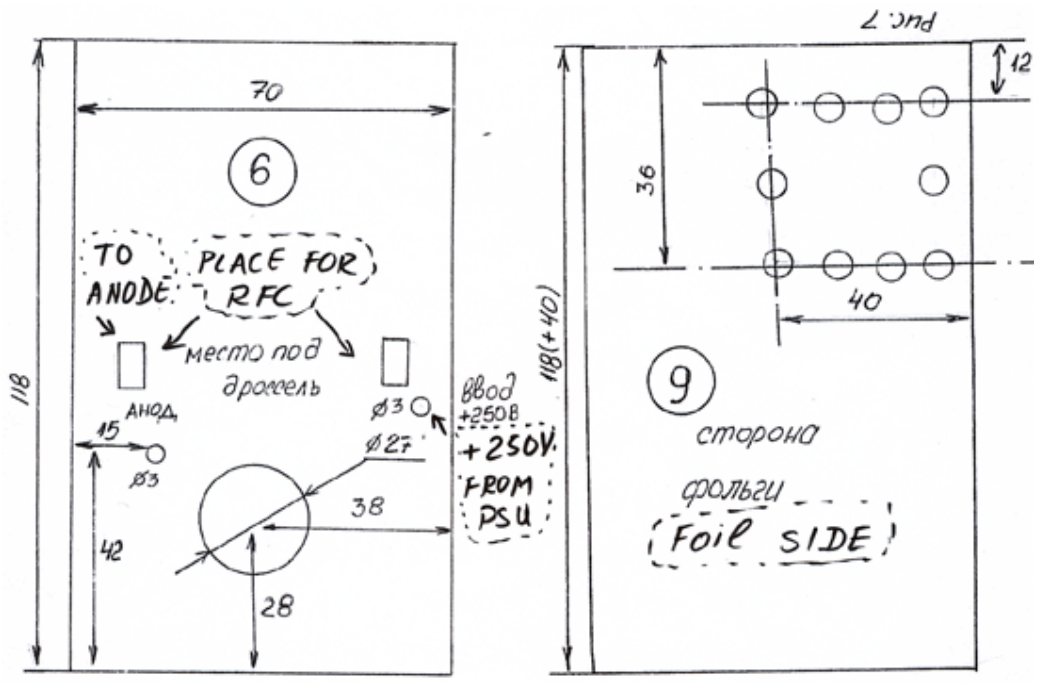
1. Have done ready items 1- 11 (do not forget that item 6 made from a double- sided PCB)
2. Have checked that all holes are made and made correctly
3. Install tubes' sockets
4. Solder edges at items 1- 9
5. Do fastened in several points item 1,2,7,9



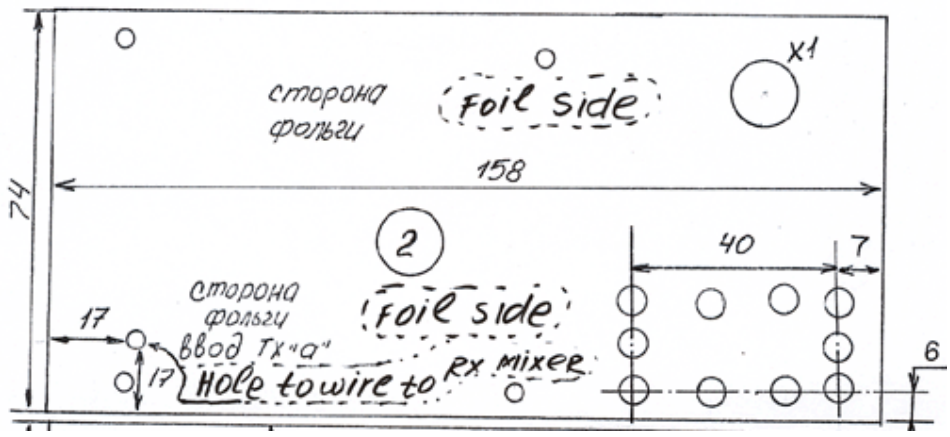
Items 3- 4

6. Do fastened in several points item 3,6,8
7. Do final soldering the (paragraph 5@6) items
8. Do montage TX
9. Tune the VFO to needed frequency range, then install item 4. VFO frequency may go down for a little.
10. Install a working board RX
11. Install item 5, do calibration of the transceiver
12. Install cover 10 and 11. Cover 11 is installed up the transceiver, cover 10 (consists from 2 parts) down the transceiver. Item 10a closes VFO, item 10b closes PA.

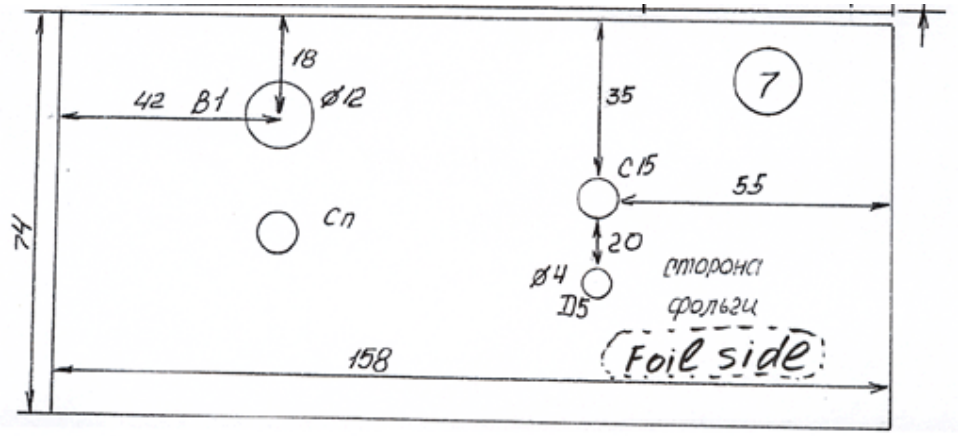
It is possible to do item 1, 9 10 and 11 a little bigger (shown in dashed line at **Figure 9**). In this case all sides of the transceiver will be closed. Transceiver will be work more stable at 20- 10 meters.



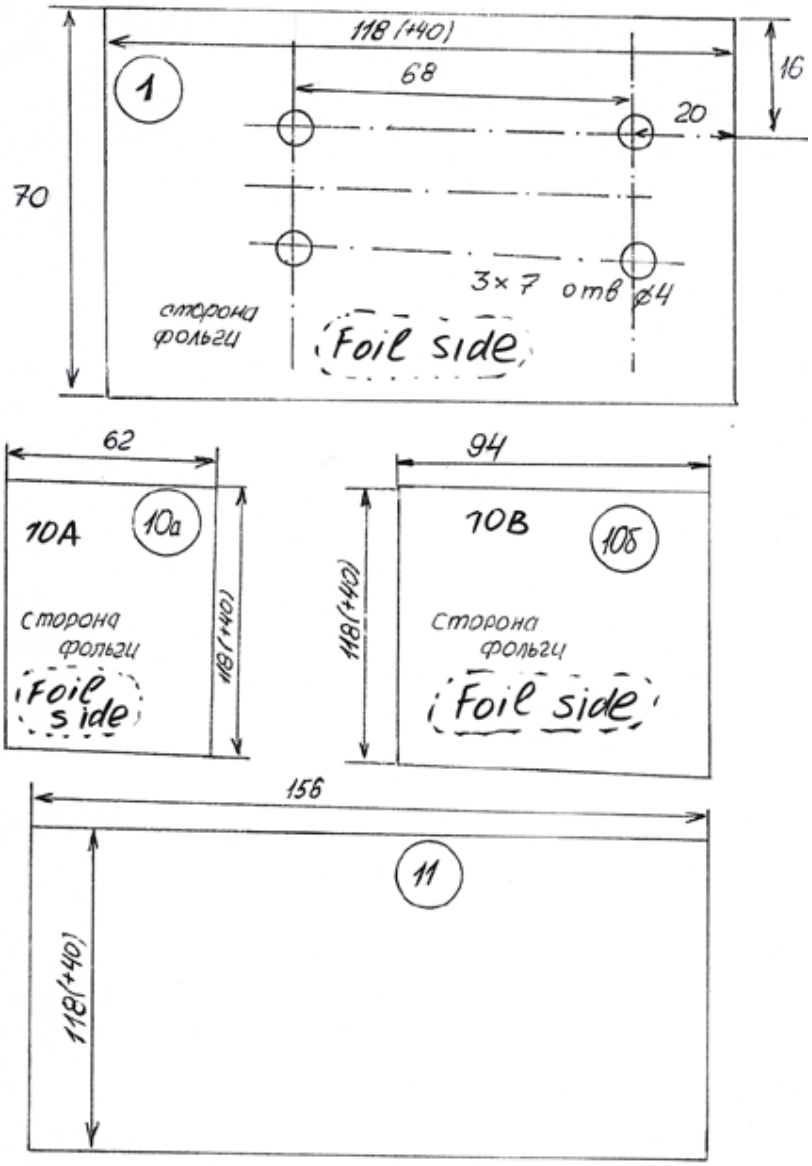
Item 6, 9



Item 2



Item 7



Item 1, 10, 11

Simple SWL HF- VHF Receiver

From the book ***"DX Reception"*** (by Igor Grigorov (RK3ZK), Belgorod, 1994), pp.:76- 81.
(Article published with inessential cutting)
See ANTENTOP- 01- 2007, p.p.: 73- 74.

Using only 4 cheap surplus transistors and 1 mixer SBL- 1 you can do a HF- VHF receiver that provides good reception on HF (12- 29- MHz) and ex- Soviet BC FM VHF- 61- 88 MHz. Receiver catches AM and FM with deviation more the 25 kHz. Such receiver allows very quickly to find a propagation on the spectrum of HF and VHF bands.

The chart of the receiver is shown on **Figure 1**. Receiver includes balanced mixer (1), low-pass filter (2), high-pass filter (3), VFO that works at 16- 33 MHz (4), superregenerative detector aka IF amplifier on 45 MHz (6). Switched filters are formed a working band of the receiver (HF or VHF). The receiver has two struck points. First lays on 22. 5 MHz the second one is on 65.5 MHz. If you want to have reception on the frequencies just move the IF of the receiver (with help of C11) up or down.

Figure 1. Chart of the simple SWL receiver

Note: The figure is original scan from the "DX Reception" book. English commentary are given inside oval.

The simplicity of design of the receiver and its high sensitivity (just at connection of an antenna in 1 meter length the receiver provides satisfactory reception on the HF and VHF bands) is reached by a superregenerative detector. However the superregenerative detector gives basic lacks of the receiver – low selectivity and low dynamic range. There is no SSB reception. **Figure 2** shows the circuit diagram for low-pass (**Fig. 2a**) and high-pass (**Fig. 2b**) filters. The filters were made for 50 (75) input/ 50 (75) Ohms output, i.e., the filters require a 50 (75) Ohms antenna and mixer having 50 (75) Ohms input. SBL-1 is okey for that. However the receiver works well with an antenna having almost any input impedance. **Figure 3** shows the circuit diagram for the receiver. If you have no SBL- 1 you may do the mixer according to **Figure 3.**

Figure 2. Circuit diagram for low-pass (**Fig. 2a**) and high-pass (**Fig. 2b**) filters
(Values for all capacitors are given in picofarads)

Note: The figure is original scan from the "DX Reception" book. English commentary are given inside oval.

Figure 3. Circuit diagram for simple SWL receiver

Note: The figure is original scan from the "DX Reception" book. English commentary are given inside oval.

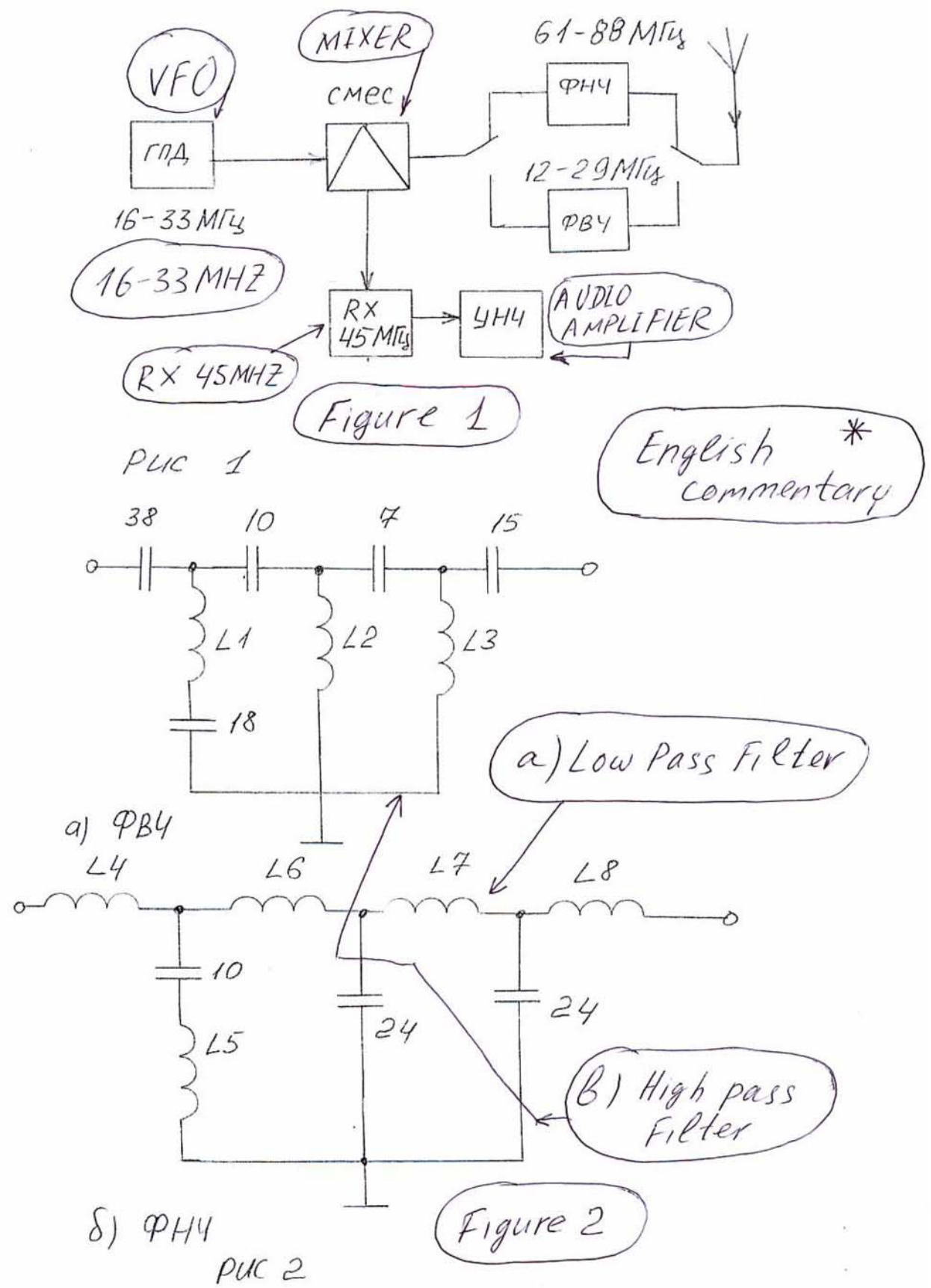
Table 1 shows data for inductors of the receiver and filters. All coils are wounded by insulated copper wire in diameter 1-mm (18 -AWG), all coils are air-wounded. The filters are assembled in a box (80X40X40- mm) soldered from two- sided PCB. The receiver is assembled in a box (155x 90x 55- mm), soldered from two- sided PCB. **Figure 4** shows component layout for the receiver. The components are sitting on the wiring strips from an old tube receiver. When the receiver will be tuned close the box, where the receiver is assembled, by a plate of a PCB. The plate should be soldered at several places to the box.

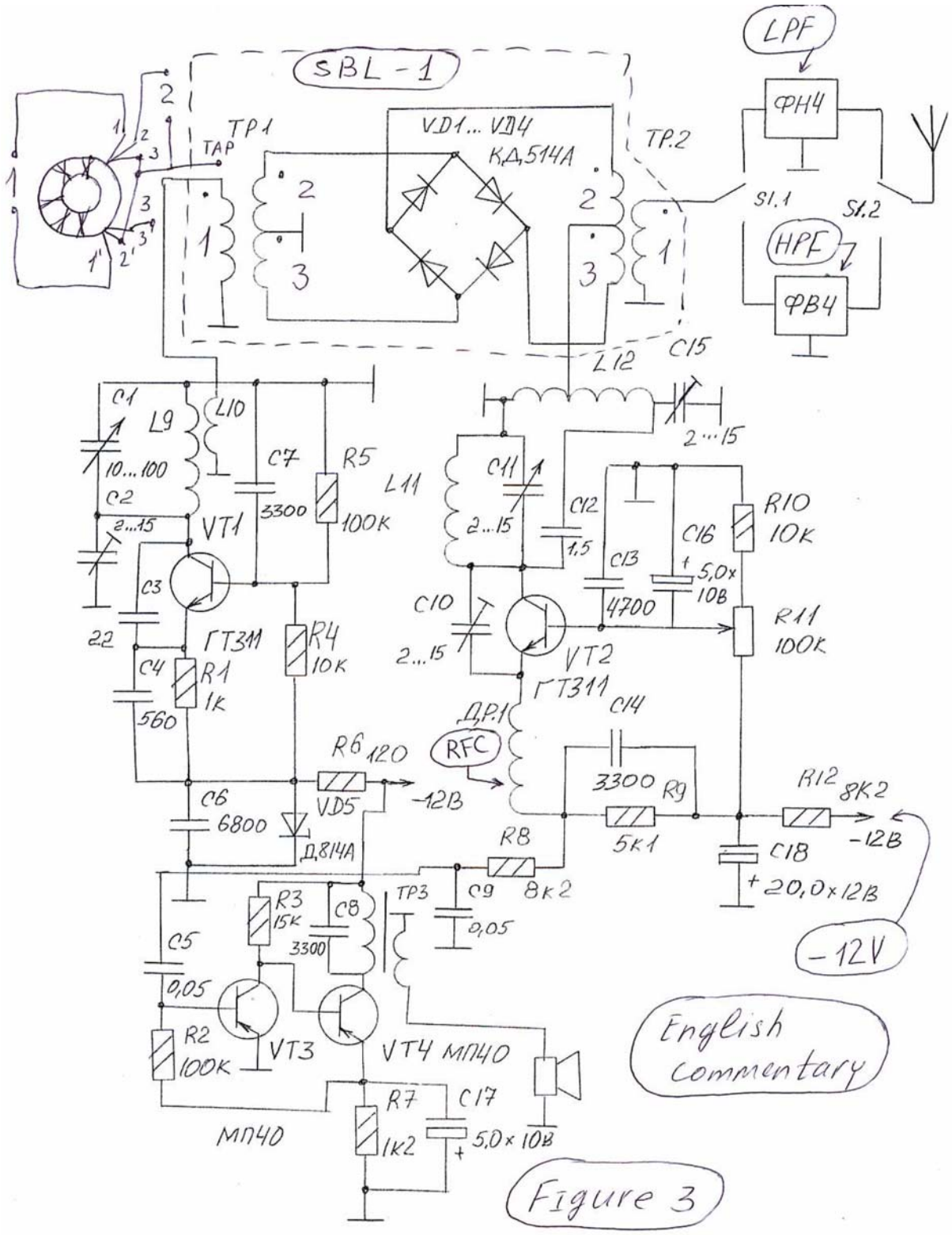
Figure 4 Components layout for simple SWL receiver

Design and Tuning

Low-pass and high-pass filter made strictly to **Table 1** and **Figure 4** does not require any tuning.

VFO made from good parts according to the schematic works straight away. Only the tuning is the set up of the frequencies range. Needed frequencies range do rough by the pressing- stretching of the L9, fine with the C2. Arrange L10 near L9 to maxima and equal across the band sensitivity.


MIXER
61-88 МГц
VFO
смес
ФНЧ
ГПД
12-29МГц
ФВЧ
16-33 МГц
16-33 MHZ
RX
45 МГц
УНЧ
AUDIO AMPLIFIER
RX 45MHZ
Figure 1
РИС 1
English commentary *
38
10
7
15
L1
L2
L3
18
a) Low Pass Filter
а) ФВЧ
L4
L6
L7
L8
10
24
24
L5
B) High pass Filter
б) ФНЧ
Figure 2
РИС 2


SBL-1
LPF
ФН4
ТР1
ТАР
VD1... VD4
КД514А
ТР2
S1.1
S1.2
HPF
ФВ4
L12
C15
2...15
C1
L9
L10
10...100
C2
2...15
C7
3300
R5
100К
L11
C11
2...15
C12
1,5
C13
4700
C16
5,0х
10В
R10
10К
VT1
C3
22
ГТ311
R4
10К
C4
R1
1К
560
C10
2...15
VT2
ГТ311
R11
100К
ДР1
RFC
C14
R6 120
VD5
-12В
Д814А
C6
6800
3300
R9
5К1
R12
8К2
-12В
R8
C18
+ 20,0х12В
TP3
C9
8К2
0,05
R3
15К
C8
3300
C5
0,05
-12V
R2
100К
VT3
VT4 МП40
English
commentary
МП40
R7
1К2
C17
5,0х 10В
Figure 3

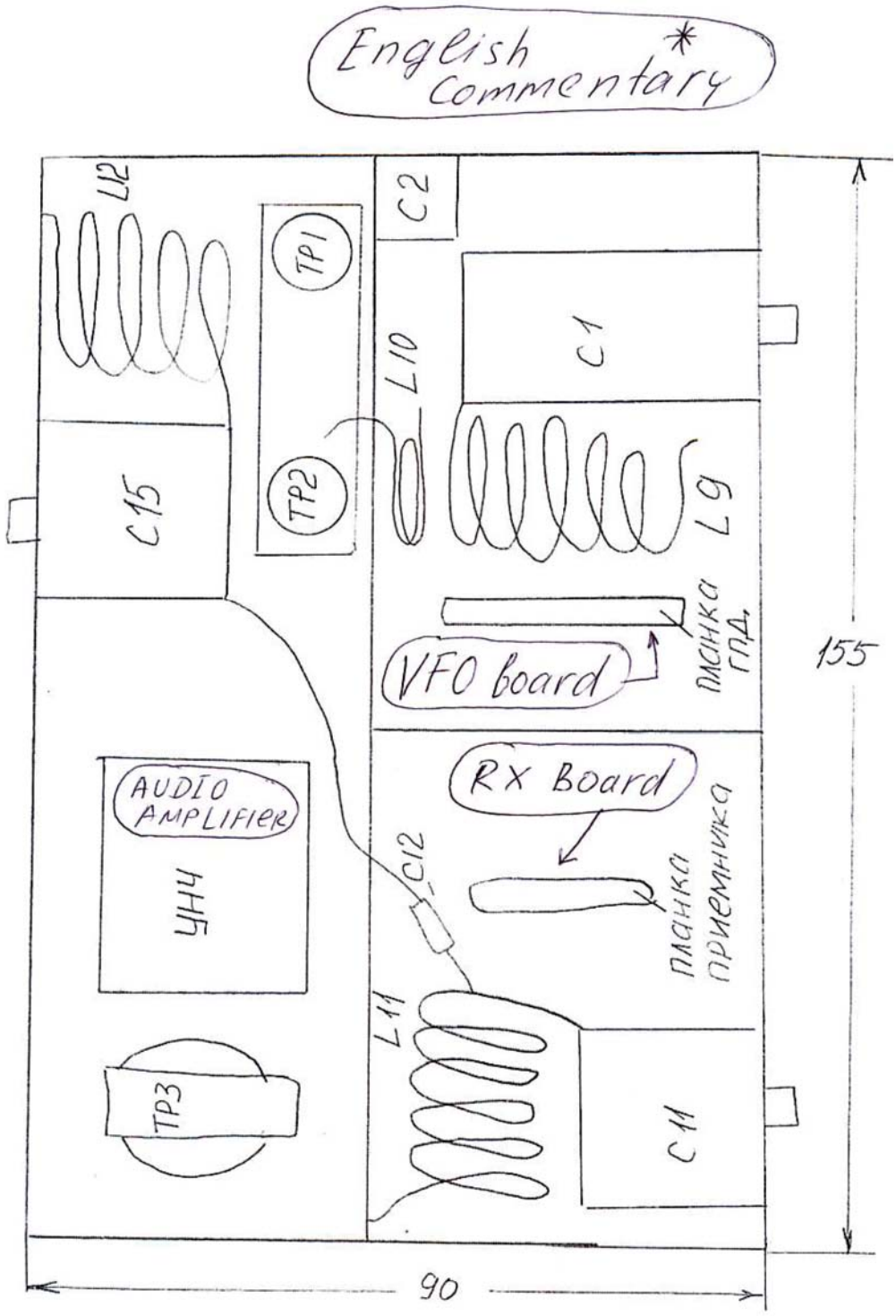


РИС. 4 Figure 4

Table 1. Data for inductors

# Inductor	Diameter of the Inductor, mm	Length of winding, mm	Quantity of Coils	Note
L1	14	10	8	Athwart to L2, L3
L2, L3	14	20	7	
L4	14	5	4	
L5	14	10	7	Athwart to L6, L7, L8
L6	14	20	11	
L7	14	20	14	
L8	14	10	6	
L9	18	25	7.5	
L10	18	4	2	Near “cold” end L9
L11, L12	18	14	8	Tap from 2 Turn from “cold” end

Superregenerative stage adjusted with R11 and C10. When superregenerative stage is working properly you hear specific noise in the speaker. Frequency of the stage (IF) set up with help of C11. After that do tuning L12C15 to maxima sensitivity of the receiver.

Audio Amplifier made from good parts according to the schematic works straight away. Almost any low power, low noise (better high- gain) transistors work well at the receiver. Transformer TP3 was used from an old transistor radio. Was used a 16 Ohms Speaker from an old transistor radio. It is possible (ever better) switch on a high- impedance head phone instead the TP3.

Parts List

Resistors:

R1: 1 k
R2 100 k
R3: 15 k
R4: 10 k
R5: 100 k
R6: 120 Ohm
R7: 1.2 k
R8: 8.2 k
R9: 5.1 k
R10: 10 k
R11: 100 k , potentiometer
R12: 8.2 k

R10: 10 k
R11: 100 k , potentiometer
R12: 8.2 k

K = multiply to 1000 Ohm
All resistors 0.125 W

Capacitors:

C1: Variable, air dielectric, 10- 100 pF
C2: Variable, air dielectric, 2- 15 pF
C3: 22 pF
C4: 560 pF
C5: 0.05 uF
C6: 6800 pF
C7: 3300 pF
C8: 3300 pF

C9: 0.05 uF
C10: Variable, air dielectric, 2- 15 pF
C11: Variable, air dielectric, 2- 15 pF
C12: 1.5 pF
C13: 4700 pF
C14: 3300 pF
C15: Variable, air dielectric, 2- 15 pF
C16: 5.0 uF/ 10V
C17: 5.0 uF/ 10V
C18: 20.0 uF/ 12V

Polarized capacitors are electrolytic

Diodes:

VD1… VD4: Any small low power RF Shottky diodes
VD5: Zener diode 9.0V/15 mA

Transformers:

TP1, TP2: Core: Amidon analog is T37- 10
10 turns by trifilar insulated wire OD 0.15 mm (34 AWG), winding to 1 cm length.
Uniformly onto the core.
So, primaly winding 1- 10 turns, secondary winding 2- 10 third winding 3- 10 turns.
● – winding phase

TP3: Audio transformer from an old transistor radio
Note: Diodes VD1- VD4 and transformers TP1 and TP2 may be changed to IC SBL-1.

Transistors:

VT1: Small power RF germanium transistor, gain 80- 100, upper frequency 250 MHz
May be changed to silicon transistor with equal data.
VT2: Small power RF germanium transistor, gain 80- 100, upper frequency 250 MHz
May be changed to silicon transistor with equal data.
VT3, VT4: Any high gain (100- 200) small power transistors

Switch:

S1: Any Toggle DPDT

RF Choke

RFC: OD: 3.5… 5 (not critical)mm
Length of winding: 15… 20 (not critical)mm
Coiled by insulated wire OD 0.15 mm (34 AWG)
Winding: Turn to turn, uniformly

73! I.G.

From forum QRP- ARCI (QRP- F- Forum)

Posted by: John AE5X,

Posted On: 07/15/07,

Subject: Russian woodpecker antenna

From UA0AAM here is the antenna used at one of the radar sites that we copy on the ham bands at times. I'd sure love to have this baby on 40m some winter evening. I wonder if it's rotatable...?

Long Delay Echoes

Feedback from summer 2007 at www.qrz.com

www.qrz.com

LDE… Several articles on LDE were published at Antentop (use google search engine to find all articles at the site). Evidence of different people from different countries shows that LDE is not a myth, LDE is the reality.

Subject "LDE" at www.qrz.com was appeared at hot summer 2007. Lots interesting commentaries were at the topic. Some of the replies (thanks for courteously permission of the authors) were pasted here. Next ball to reality of the LDE

QRZ Forum » QRZ News » Ham Radio News » **Long Delay Echos**

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Topic: Long Delay Echos < Next Oldest | Next Newest >

g4tut

Posted: July 09 2007,04:12 "QUOTE"

Long Delay Echos

Group: Moderators
Posts: 227
Joined: Sep. 2005

Long Delay Echos (LDE) have long been a source of fascination to Radio Amateurs.
Over the years there have been a number of reports of Radio Amateurs hearing their own transmission delayed by as much as 9 seconds.

W5HTW
Posted: July 09 2007,08:21

I also experienced an LDE while working for the US government, in the mid 1960s. It was on CW.

It was only a portion of a regular one-minute long transmission we made, automatically, on a guard frequency. Our guard sent one minute of CW then one minute of monitoring. We monitored simultaneously four different HF frequencies, on speaker monitor, as we were often away from the operating console.

Following one of the one-minute transmissions, a few seconds after it stopped, part of that transmission was repeated back, but since I was not at the console I do not know on which receiver it was heard. At the time we were monitoring frequencies at 6, 10, 13, and 18 mhz. My guess would be the 13 mhz frequency, but it is only a guess.

The duration of the echo was only about 10-12 seconds, not a complete retransmission. It had no fade. It was on frequency, so was not shifted by any Doppler.

It was our signal, same speed, same automatic keying characteristics, same everything. We had a tape of it for a long time, and I had a copy of the tape, but at some point, years ago, I lost it or erased it.

LDEs are real. It appears the most logical solution is some sort of ducting, the signal returning to earth in a moving path, which accounts for it being heard only briefly at the originating site.

Ed

Ed wrote an interesting article on LDE that is at his website : http://w5htw.home.att.net/index.html. With Ed's kindly permission the article is printed below.

LDES - LONG DELAYED ECHOS

There are stories told in the cult books of radio signals being heard again years after the radio station left the air. One such story involved a broadcast AM station that had closed down, yet the radio signal was heard nearly two years after the station went off the air.

Those stories are like the UFO and ghost stories. They have no foundation.

LEDs, though, are very real. What they are not, are attempts by some alien space craft to contact us. What they are is an as-yet unexplained electromagnetic phenomena relating to radio waves. In the 1960s Stanford University's Physics Lab tried to find an explanation for them but LDEs have no apparent useful purpose, so allocating much in the way of scientific time or funds is pretty unlikely. The study closed with only a few suggestions.

There are some facts available about the standard LDE. First, it does not show signs of Doppler shift. It is on frequency, it remains on frequency for the duration, and the pitch, if it is CW, remains steady.

Secondly, it is rarely a full transmission. It is segments, often very short segments, only five or six seconds, of a transmission. It may not begin at the beginning, and it may not end at the ending of the original transmission. It is not complete.

Third it does not fade in or fade out. It is "there." At least that is true of the one I heard that was so clearly identifiable. It turns on, and then it turns off.

Fourth, they have been showing up LONG before computer sound cards. While it is possible one or two could be a hoax, it is highly unlikely.

Fifth, they are not limited to the ham bands.

Sixth, reports of them are mostly in the 3 to 18 mhz range. Occasionally one is heard above that, and on very rare occasions, one below that. This could be because most radio activity is in that range, so it really isn't a defining fact, but it is a point to consider.

MY OWN EXPERIENCE

To my knowledge I have heard only one LDE. It is possible I have heard others, but did not recognize them as such, perhaps due to crowded band conditions, or other situations. The one I heard, though, was unmistakable. To explain it, I have to set the scene a bit. This was in 1967, in the Far East.

I was a government radio operator/tech at a somewhat isolated radio relay site. We ran a CW net that was used almost entirely for the purpose of establishing contact and setup procedures for RTTY operations. Hence it carried very little, and very intermittent, CW traffic. We ran three or four transmitters simultaneously, depending upon time of day. We ran four receivers (Collins 51J3/R388) models in a console. There was a J38 straight key for our use. There was also a Frederick Electronics Baudot to Morse converter, that converted 5-level punched paper (or plastic) TTY tape to Morse. We ran what is typically know as a "guard" frequency. You've heard them on the marine bands. It sends something like: **VVV VVV VVV DE KGP444 KGP444 KGP444 QSX 4/6/10 K** And then there is silence. That is the listening period.

Our machine sent this (and this is a fictitious call sign, not the one we used)

VVV VVV VVV DE AAA123 AAA123 AAA123 VVV VVV VVV DE AAA123 AAA123 AAA123 VVV VVV VVV DE AAA123 AAA123 AAA123 QSX 4/6/10 K (In the day time the freqs would change to 6/10/13)

That sequence, at 18 wpm, took just about one full minute. The tape then looped (using "letters" characters) for another full minute, during which time any station could call in.

Long Delay Echoes

Because our transmitters were located a couple of miles away, we ran the receivers at full RF gain all of the time. There was NO muting! All four receivers were wired to a speaker panel. That meant any signal heard would be heard throughout the building. Twice each hour, on the hour and on the half hour, one of us (there were usually only two on duty) would actually sit down at the receivers for "close monitor." For that, we switched the speakers to a panel down near the desktop, and we would sit for two minutes and monitor. At all other times, the operator was away from the position and doing other things, so he had to be able to hear the R388s above all the Teletype noise in the building - and we had a LOT of such noise! Motors for printers and machines, plus air conditioning, fans, and the like. So the receivers were very loud.

When our transmitters keyed, the AGC action of the receivers served to mute them, as we kept the AGC slow. The first "beep" of the CW shut down the AGC, which prevented any full breakin. There was no other muting. Just pretty much receiver overload!

Now the scene is set. It is not close monitor time, and I, with my partner, am doing other work in the RTTY section. We grow accustomed to hearing the receivers go dead as our own transmitters overload them. Then the background noise returns.

Suddenly we hear: **VV DE AAA123 AAA123 AAA123 VVV** Then it's gone. It lasted perhaps five or six seconds. It did not fade in, it did not fade out. It "turned on' and then it "turned off." It was our keying. At our speed, and automatic. It was strong, but nowhere near strong enough to kick the AGC and overload the receivers. It was not strong enough to even "thump" them. It was simply a fairly strong CW signal.

For an instant I thought it was someone calling us. Since that did not happen unless there was a problem, I moved quickly to the console. I stopped our automatic keying and I listened. No one on any of the frequencies. I sent "QRZ DE AAA123 K" with the hand key. Got no response. I tried that maybe three times. No one was out there. Of course I was keying all four transmitters simultaneously, so no matter what frequency he had called in on, I would hear him.

Then it dawned on me! I had heard "DE AAA123!" He had been identifying as my station! Not AAA123 DE AAB321, for example. It was "DE ME!"

By sheer luck, we had been running a slow speed monitor tape on another receiver in a different rack. That was a rack with two Collins 51S1 receivers, that we used to monitor other things, but it had been set up to monitor a couple of frequencies, and I had, earlier in the afternoon, set one of those two receivers on one of our guard frequencies. The other was on some other frequency.

What if, I thought, the echo had been on that particular guard channel? I had no way of knowing which of the console receivers had picked up the signal but it was early evening, and we had been about to close down the 13 mhz guard, as it was no good for us at night, so it wasn't likely it would be there. I could be on our 4, 6 or 10 mhz frequencies, and there was no way of knowing. But the 51S1 was on the 6 meg guard frequency. What if!

I ran the tape back. Yes, indeedy, it had been on the 6 mhz guard frequency. And I had a tape of it. Not only that, because because the four channel recorder used one of its channels to permanently monitor a highly accurate 1 KHZ oscillator, I could now tell precisely what time the signal had been recorded, using our test gear designed for that purpose.

All that told me nothing. Except it was not one of our field stations. It was not our own transmitter being keyed by our keyer. It was a received signal, and in ham language would have been RST589. We gave it a QRK5, QSA5. The only thing I knew for sure about it now was it had been on our 6 MHZ frequency, not on the four or 10 mhz one.

I made a copy of that segment of the tape, as it was something we wanted our technical staff to analyze for us. They did, and learned nothing more. I kept the tape for a few years but finally erased it.

Shortly after the actual occurance, (perhaps a few months) which neither my coworker or I understood at the time, I happened across a story on LDEs. And then we knew what we had heard. Again I played the tape several times, but garnered no information from it.

Except one thing. The "echo" had begun 16 seconds after the end of our transmission. But it had not begun at the beginning. It had not echo'ed our entire transmission, only a few seconds of it.

All this took place outside the USA.

Some things we did know. It was not ham operators. It was not a hoax. It was not foreign intelligence. It was not one of our own transmitters. It was not a recording. (thank about that one, and why you know it was not an audio recording!) It was not one of our field stations. It did not fade. It had no Doppler. It was our keying, at our speed. It was reasonably strong, but not enough to trigger AGC on the receiver. It was very clear, with no QRM. It was in the 6 MHZ band.

I have never heard another one. I have some theories about LDEs, but I'm no scientist, so I just keep them to myself, mostly. I think the key, though, is the word 'ducting.'

Have Fun.

K8VPL

Posted: July 10 2007,07:15

An LDE happened to me once, back around 1963, at a near sunspot minimum. About 3AM Eastern Time, I don't remember what season, I was trying to hear ANYTHING on 40 meter CW. The band was dead, and the noise level was very low. I had called several CQ's, and heard the last several letters of my call coming back about 3 to 4 seconds after I sent them. I tried a few "dits", and they came back just as I sent them. This went on for about 5 minutes. The returning echoes sounded like they had come a long way, all fluttery, and just above the noise level, but on the same exact frequency, and matching my fist exactly. I'll never forget what they sounded like.

73
Ted, K8VPL

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aa4w
Posted: July 12 2007,19:12
I just wanted to add my experiences with LDE's. In the late 60's I spent quite a bit of time on aircraft carriers in the Mediterainean and we were running lots of phone patches. On numerous occasions I heard the last several words we had transmitted after we unkeyed the transmitter. At first I thought it was someone playing a prank but I soon realized it was our signals. The delays were longer during times when the propagation was best and as I remember I never heard them during daylight hours which figures in with the ionaspheric conditions. I agree it is an odd sensation the first few time you hear it.

Rick AA4W

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n9kpn, Tim

Posted: July 18 2007,15:37

I experienced LDE on 11M (CB SSB) back in the late 80's. A friend would be in town and drive to college some 50 miles away. He'd go mobile and I'd use my base station. The almost half way point, 27 miles, was where we would have to sign off. Sometimes we'd make it a little bit longer, but rarely too much farther.

One evening as he is headed back to school as he got further apart, we kept hearing another station jump in. He'd hear one when I talked, I'd here one when he talked. But they would not reply when we addressed them. As he got further away we noted that we were hearing a delay of the original transmission! Once past the half way point we could hear each other from the delayed transmission. This was one of the only times we could hear each other the full 60 or so miles. Eventually the echo faded and we lost contact.

73! I.G.

Time Warp

Feedback to the Article

Article ***Radio Signals out of Our Times*** was published at Antentop 01- 2006 as well as at www.cqham.ru. Below I paste only the feedback on the article from www.cqham.ru. Also I paste a feedback received by me on my email. You see, another hams also have met something like Time Warp in the Air….

July 26, 2006, Maxim, 4Z5PM:

Already during several weeks every night in the time from 24.00Z till 02.00Z on CW segment of the 20 meters approximately each 40 minutes a propagation to South America is appeared. Duration of the propagation is from 2 to 8 minutes.

Does someone observe a similar?

August 27, 2006 at 02:07 UA1TAT:

All these facts (at the article Time Warp) break not the laws of the Nature but only our current knowledge about the Nature. It would be very interesting to collect the facts and then to study them. I met with the strange phenomena of Time Warp. At November 1984, at 144,050 MHz, I had heard my own CQ that I sent 14 minutes ago. I was very surprised because at the times only few hams from my location used to the 2 meters and I was familiar with all of them. So a joke from somebody was impossible.

I know some people who have came in to a forest at one place but came out at another place that was very far away from the place. They could not go so far by feet for the time. It really was and I wish see you while you be told to these people that it could not be.

August 28, 2006 at 20:33 RA9LZ

Yes, somebody may smile and sayl “crazy author.” I could be done so, BUT… In the middle of 80s at one evening I sent CQ on the 40 meters. Nobody answered me. I went to my kitchen for a cup of tea. When I came back in the shack I heard my CQ from the transceiver. Pirate, had thought I. Again I sent CQ and through several minutes I had heard my CQ coming back from my transceiver. Okey, I retuned my transceiver from the being frequency to several kHz apart, then wrote in the memory of my key my callcign (it was UA9LCT) with random letters, stand key at maximum speed and shot it into the Air. I fall from my chair when through several minutes I had heard the same from my transceiver. The phenomenon was lasted in the Air near 20 minutes... 73! Alexandr

September 1, 2006 at 00:55 Gun

… When I have read this article, I have remembered one episode from my life. I just had received my first callsign and then through a short time I had received QSLs with date that was one year before I got my ham license. There were QSLs from Canada and Yugoslavia. At all QSLs my report was 599. I would like reminded at first I had got 3- amateur category (at the USSR’s qualification) that did not allow me to make QSOs with these countries. What it was, mistakes of the operators or something else?

September 7, 2006 at 15:16 Alexander T

I very often meet one- way propagation at 10 meters. I have received (or only somebody has received my station) with 57- 59, but somebody (or me) hear nothing. QSOs were duplicated via ICQ. I very often hear small LDE in 0,5- 2 second from Radio China at 19, 25 and 31 meters.

September 7, 2006 at 14:54 AlexanderT

Sometimes when I have listening DX broadcasting station, I mention, that time signals, that was transmitted by the stations not correspond to my local time. Maybe the radio operators of those stations turn the time signal directed of their own hand- watch.

In the beginning of 80s, when I lived in the Northern Caucasia, I had received to my broadcast VHF receiver audio from TV that was going to 2 hour before real TV broadcasting. So, I could tell to my amused friends who was a winner in hockey or football. I can not understand how I could have received such signals…

Time Warp

September 14, 2006 at 16:53 UA4CR

In July of this year (2006), I was sitting before my transceiver and hearing the Air. Suddenly I heard: CQ 20, CQ 20, Radio Papa Nine…. Lots radio stations answered to the call, a real pile- up. I could not understand nothing, because radio station with RP9… were working in Russia only at May. It is special callsign devoted to the Victory day (9 May, 1945). The station was working 10- 15 minutes, then go to very deep QSB. I have understand, that in July I have heard special station that worked at the May on Victory Days (but from which year?)… At the time a noise was very high at the 20 meters…. 73, Vyacheslav

September 19, 2006 at 22:15 UA4HVS:

I heard from somebody about strange phenomena that is occurred near 11 MHz. It looks like the radio signals with spectrum 3- 4 kHz near the frequency (11 MHz) was recorded during 15- 20 second and then transmitted in reverse spectrum. Like tape recorder, record any signal (ever noise) and then transmitted it in reverse…

September 20, 2006 at 21:01 UA4HVS:

I have some records (made by me) of LW broadcasting with echo in some seconds. Real echo… I do not know how it can be…

September 22, 2006 at 22:08 Andrey, RW4NA:

I want to thank the author for the article… It is very interesting theme. I would like to say what was happened with me. On 1982 year I was served in the Soviet Army, in a division located in Kemerovo region. I had chance to hear amateurs bands at the Army. One time I had heard at 40 meters with strong QSB CQ de UA4NAS (it was my callsign at the times!!). I recognize my hand key, it was really me! I heard that lots stations were calling UA4NAS but the strange UA4NAS gave CQ and CQ like it did not hear anyone. I was very choked by this. It was in real…

September 24, 2006 at 00:10 Sergey RW6AMP

I decided to add some stuff from me. Some time ago (may be 1- 2 years) I have got returned several my QSLs from Germany with the mark “No the Callsign. “ I checked the callsigns in databases from the internet. Really, there are no these callsigns. I was very surprised because I usually send my QSL (in Europe) in two cases: or the correspondent ask me about QSL either I reply to received QSL. So, I send the QSLs on request of these stations. As you know, a pirate, as usual, do not request for QSLs. I am on the Air very long time and I never do mistakes when I receive a callsign of my correspondent….

Time Warp

September 29, 2006 at 21:48 Aleksey UA9W **

When I have got my callsign I sometimes spent in the Air 8 hours per day. I have used only CW. I look for interesting stations so I mostly heard the Air. Several times I heard how a station with the same callsign like mine worked in the Air with another stations. Copy cat, I thought, but very talent copy cat because he sent CW practically like me… When I have read the article I recognize that may be I have heard me from others times.

October 10, 2006 at 02:43 V.V.

"There are things, which we can not know, but it is impossible have known, what is these things".

In 1973 I was a schoolboy who is a radio fan. I made a wireless adapter (schematic was published in soviet magazine Radio). I t was one- transistor VHF transmitter that can be received in distance of 10 meters. I connected the adapter to my tape recorder Nota and enjoyed hearing of the record of music of a local jazz- band from my home receiver that was switch on to VHF band. The receiver was placed in the distance of 5 meters from the tape recorder. When the tape was finished and tape recorder was stopped I turn the receiver to HF- band. Suddenly, when I look for HF stations (as usual I look for Voice of America), I heard the music that I transmitted 15 times ago. Like a stupid I stared to my stopped tape recorder with standing tape and heard the music with all defects that was on my tape. Unknown station had transmitted all the music and stopped at the same place like at my tape. After that only the silence was at the frequency… I was astonished I could not understand nothing… I was heard my broadcasting after near 15 minutes when I had stopped the tape. More, I had heard the broadcasting on another frequency (in another band!). Until today I can explain the situation only like devil's joke…

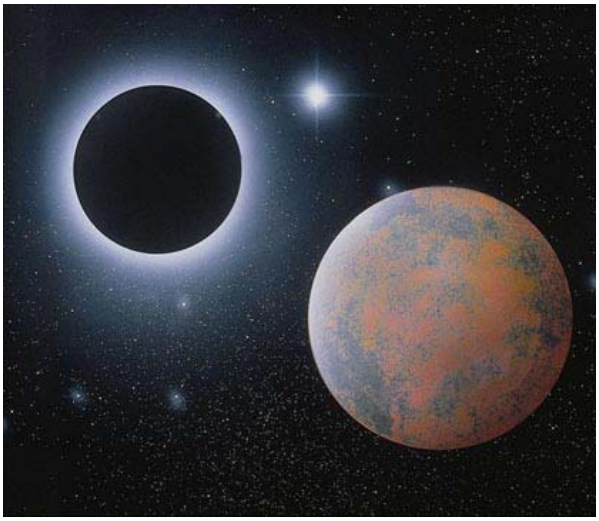
I. G.: Also I have received on my email some very interesting feedbacks to the article Time Warp. One feedback I paste below. The ham, who sent me that feedback, has agreed to publish it only under condition of complete anonymity.
== I want to describe a strange case which has taken place with me.

I had obtained my ham license in 1977. Then I was active mostly CW on 40, 20 and 15 meters. But in summer of 1992 I have decided to try a 160 meters. I installed a sloper in 42 meters long. One end of the sloper was tied to my balcony (9 floor) another end was tied (through a gay) to a light pole.

For the 160 meters I have used a home made one band transceiver (design of UA1FA, Radio #4, 1980) with PA made on 3x GU50 (GU50- a Russian tube, can give near 100 watts at 160 meters). In that summer I have done lots interesting QSO's. From these QSOs I have remembered a QSO with 4X4xxx, Israel. It was my first 4X4 on 160. It was 599 in both ends. Near half of hour we chatted about our equipment and life. It turned out, that my correspondent was immigrated to Israel from the USSR in 1981 year. I have sent my QSL to him but never have got his QSL.

In the winter of 1993 the sloper was broken by a storm wind as well as the storm broken my antennas for HF- an I.V. for the 40 meters and an UW4HW (broadband vertical) that I have used for the 20 and 15 meters. I could not fix the antennas straight away after storm. Then, in the 1993, my company did global cutting and I was dismissed. My live turned down I looked for any job and I had no time to fix my antennas and to work in the Air. In 1996 I was emigrated to Israel.

Through several years of my life in Israel I found a job at a very good company according to my qualification of Electronics Engineer. It was amused but in one of the departments of the company it was worked a ham with whom I had QSO in 1992. I talked with him about the QSO, it is occurred that he also had remembered the QSO, he sent me a QSL and did not get nothing… I told him that I also had not received his QSL. Through several days he met me and gave me a QSL for the contact. On the QSL the date was 1993, when I did not work in the Air. I told him about the mistake. On the other day he brought his log for 1993 where the QSO was written. I did not want looks like an idiot (only got good job), so, I told him, well, it is my mistake, of course, the QSO was in 1993… But I know that I did not work in the Air in 1993! ==



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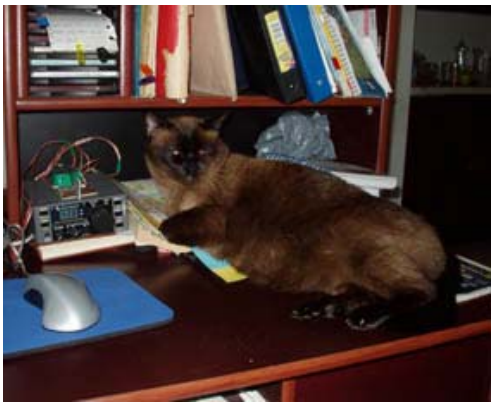

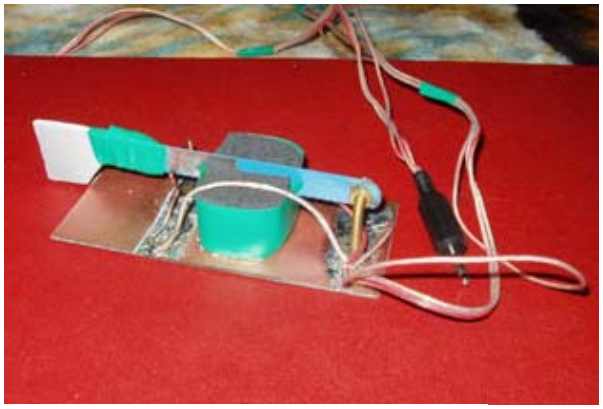

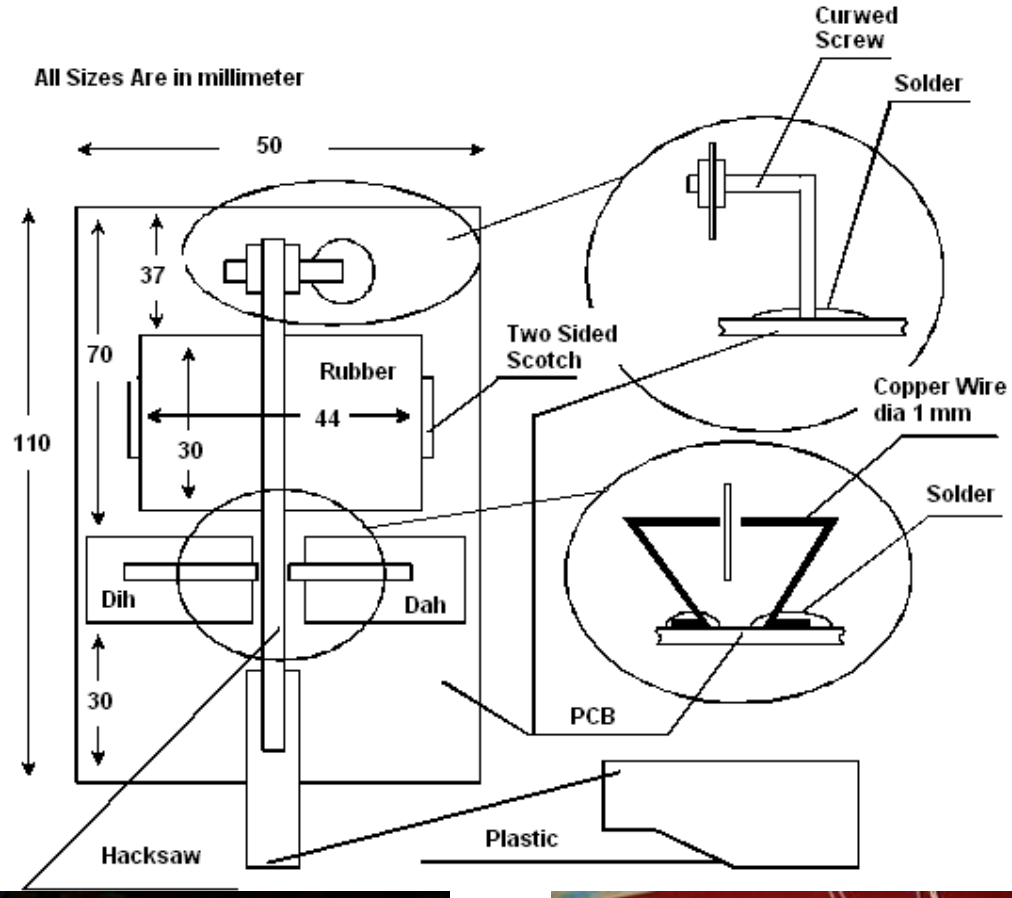
All Sizes Are in millimeter
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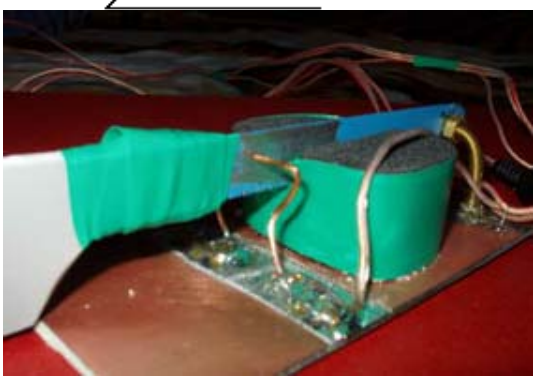

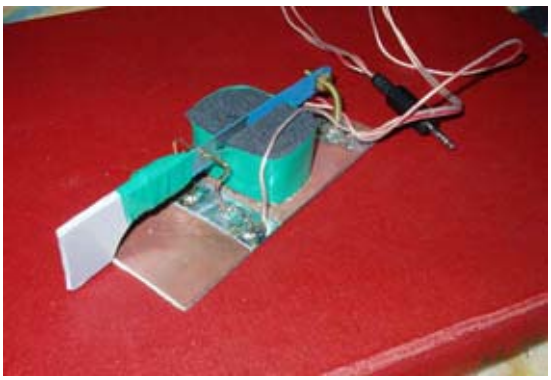

QRP Transceivers and PAs from Accessible Parts

Book in Russian "***QRP Transceivers and PAs from Accessible Parts*** " (*pdf), 28 pages. The book was published by me (on my own expenses) in 1991, in Belgorod, Russia. I had printed 2000 samples of the book. Of course, it was not best paper used for the book as well as not good quality of printing. The book describes kits which my own company ("Vibrissa") produced at the times. Naturally, the book was the manual for the kits. Were produced 400 kits of TST (Tube- Semi- conductor- Transceiver) near 50 of them were assembled by me for customers, 200 kits SQT (Semi- conductor- Quartz- Transceiver), near 30 of them were assembled by me for customers, 200 kits of PA, near 60 were of them were assembled by me for customers.

Well, 1991- 1995 years were very interesting in my life in Russia. For now I have only 5 samples of the book, other ones were sold. I have no boards for the transceivers and PAs.

But you, if you want, can do the equipment again. The book contains copies of the PC- boards, manuals for tuning. The equipment is really the equipment that works great.

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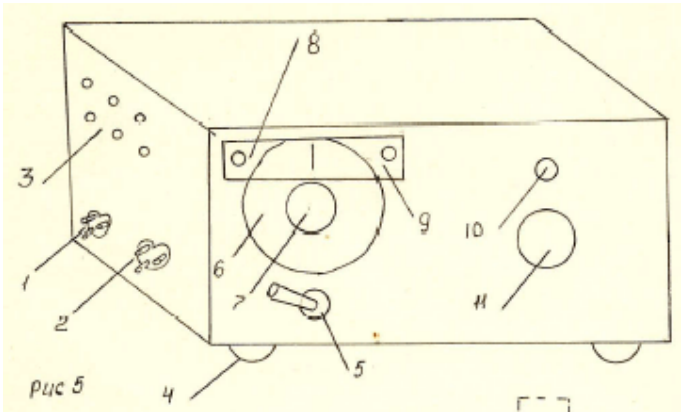

Transceiver TST

QRP Transceivers and PAs from Accessible Parts

Free e- book!

**28 pages in 5- 1/2"x 8" size *
(Pages 1- 23 were scanned from 8- 1/2"x 11"sizes medium)**

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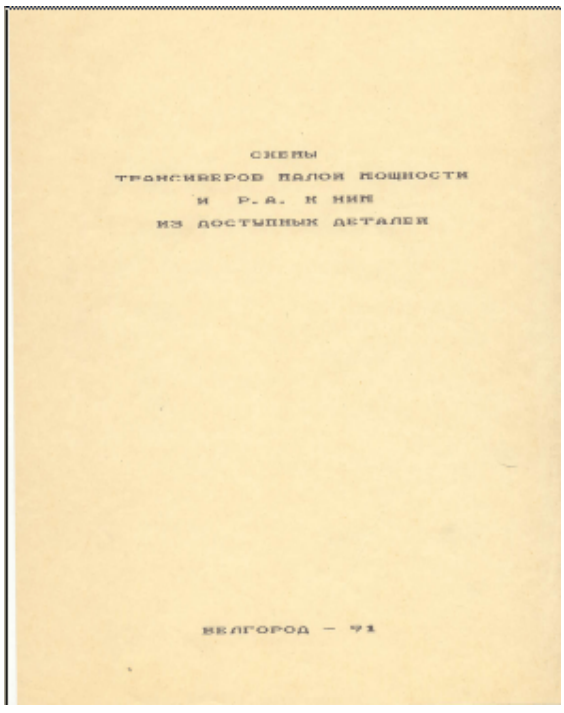
http://www.antentop.org/library/

In near future I will do translation of the book to English… For now you can see translated pages 1- 13 (**AntenTop 01- 2007**). Another's coming.

Notice: Pages 24- 28 were scanned from original book (not from printery medium, I have lost the pages….), so, sorry for quality.


СХЕМЫ
ТРАНСИВЕРОВ МАЛОЙ МОЩНОСТИ
И Р.А. К НИМ
ИЗ ДОСТУПНЫХ ДЕТАЛЕЙ
БЕЛГОРОД — 91

QRP transceivers and PAs from accessible parts

DX Reception

Book in Russian "**DX Reception**" was published by me in 1994, in Belgorod, Russia. It was printed (for my own expenses) 2000 samples of the 96- pages book. Only 1 of them I have in my stock for now.

A long time I have been a fan of DX- SW radio reception. Till now I with great enjoy listen SW radio. It is really fan for me. The book contains description of antennas, some useful circuits, advices for DX- reception. All the antennas and circuits were proved by me.

I made scan of the book (sorry for quality, was used a real book, not a printery medium) and now it is available in *pdf both at the site ***AntenTop*** as at ***CD AntenTop***.

DX Reception : by Igor Grigorov, RK3ZK

Free e- book!

96 pages in 5- 1/2"x 8" size

Download!
http://www.antentop.org/library/

I hope I can do translation of the whole book in English in the future. However ***AntenTop 1- 2007*** already contains an article "Simple SW- VHF Receiver." The article is **Part 8** from the book. **Part 4** (White and Black Spots of DX Reception) was translated in English (with some changes) and published at on- line magazine ***Antennex*** (www.antennex.com) at December 2002 under the title: ***Earth Spots.*** Feedback to the article you can find at ***AntenTop 1- 2003***.

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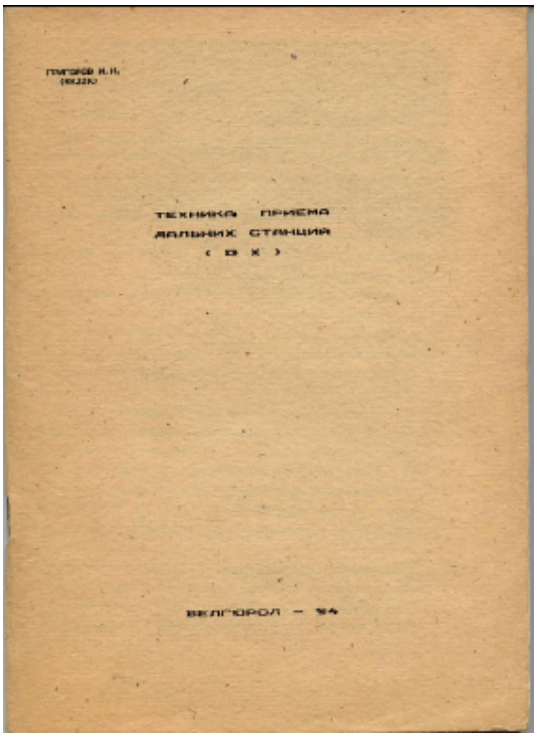


DX Reception

Table of Contents

May be the first receiver for DX?

RAEM/mm Is My Callsign

From "RADIO" #12, pp.: 20- 21, 1973.
Translated by Mike, G4AYO

РАДИО

http://www.radio.ru/

On 24 December 1973 Ernst Teodorovich Krenkel would have been 70 years of age. But an untimely death cut short his life at 68 years. The memory of him and his deeds remain with us, his contemporaries and friends, for ever.

One of the first polar expeditions of Ernst Teodorovich was a wintering on Franz Josef Land. Now, the polar geophysical observatory of this archipelago on Heys Island is named after the legendary radio operator.

Great work was accomplished by E.T. Krenkel during a two year wintering on Severnaya Zemlya (North Land). In memory of his stay in this bleak and cold territory, a bay, situated to the north of the archipelago, was named Krenkel Bay.

For many years Krenkel-explorer returned to the hydro meteorological service. A new scientific weather research vessel - the Ernst Krenkel - recently left on a voyage.

This was in recognition of his major contribution to the development of radio communications and amateur radio at the Central Radio Club USSR in Moscow.

The last voyage of E.T. Krenkel - a voyage to the Antarctic Circle, took place in 1968. He headed a voyage of the scientific-research vessel Professor Zubov, which was bound for the shores of Antarctica to relieve its staff of winterers found there, and also for oceanographic research.

Below we publish extracts from the diary of E.T. Krenkel, which he kept during the voyage on the Zubov. He was a gifted narrator, graphic, with apt language in which were no trite sentences or clumsy wording. Ernst Teodorovich appears before us as a very ordinary man who with boyish ardour is concerned with his daily watch on the air for radio amateurs.

14 November. Embarkation on Zubov was set at 8 a.m. The day was grey and dark. It was frosty. In Neva almost solid pancake ice. In my cabin there was a crush. Treshnikov, Korotkevich, Chukhnovsky, Somov, Osterkin and still more familiar and unfamiliar people arrived. A mass-meeting was conducted. Treshnikov (Director of the Arctic and Antarctic Scientific Research Institute) and I paced. Those seeing us off were asked to leave the vessel. On the gangway there was no passing: embraces, kisses, moist eyes... A tug slowly began to pull us. There were collective cries, waving of hands and a dwindling crowd of those seeing us off on the pier.

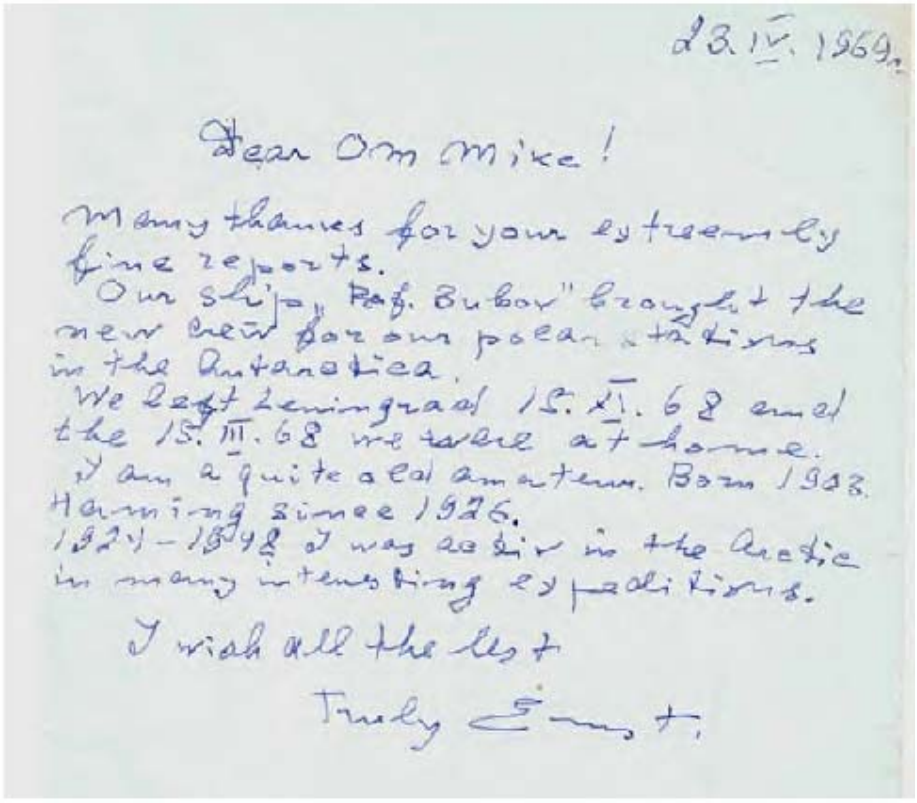
17 November. In the evening we passed by Cape Skagen. We established radiotelephone communications with the diesel-electric Ob, thanks to which was made our original radio-acquaintance with the future governor of Antarctica, Dmitri Dmitrievich Maksutov. Audibility was excellent. We worked on a transmitter with a power of one kilowatt.

22 November. On the horizon Spain is visible in the haze. The warm weather is wonderful. Towards evening the choppiness intensified to wind force 7-8. Stabilising sails were let out and on a rather stormy sea we tore along almost like Chest pond...

24 November. Warm rain lashes down, all around was a grey hazy mist, through which are visible the mountains of Grand Canary island, on the eastern side of which is located the port of Las Palmas. The island is beautiful, but sombre. A vast high steep stony shore stretches to the sea. In valleys and ravines there are small settlements with tiny white houses. There are no anchorages - the depth is too great. Among our sailors an argument arose, which most resembled Grand Canary: the landscape of Murmansk or the coast of the Crimea?

Pictures Credit Line:

http://www.qsl.at/deutsch/gr_krenkel.html
http://hamgallery.com/qsl/country/European_Russia/upol2.htm
http://www.vintagepostcards.com/



23. IV. 1969.

Dear Om Mike!

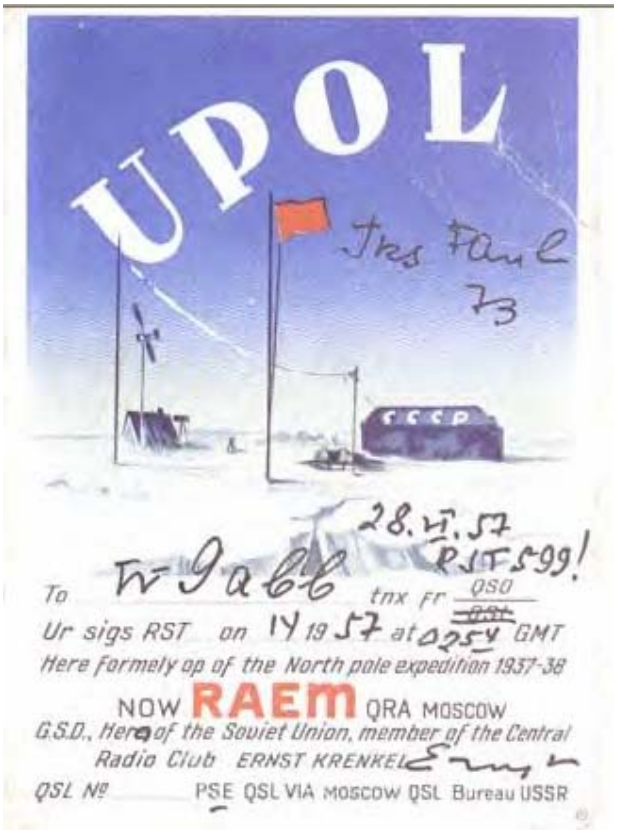
Many thanks for your extremely fine reports.
Our ship, Prof. Bubov" brought the new crew for our polar stations in the Antarctica.
We left Leningrad 15. XI. 68 and the 15. III. 68 we arrive at home.
I am a quite old amateur. Born 1913. Hamming since 1926.
1932 - 1948 I was active in the Arctic in many interesting expeditions.
I wish all the best
Truly Ernst.

Letter from RAEM to G4AYO

26 November. Our vessel slowly, without the help of the tug, went into the rather small port of Las Palmas. It astonished the Spaniards with its ability to move sideways - we worked with a special reactive rudder. First trouble after putting into port - restocking of diesel fuel. It is unlike being in a queue at a Moscow petrol pump, but is in essence the same.

28 November. We took on supplies, fully loaded the refrigerators with vegetables and fruits for our "polyarniks", polar explorers in the Antarctic. After a four day stop we left Las Palmas. Then our route is without a stop to Mirny, where we met up with the Ob.

In the morning I received the good news that I had been authorised to work on the air from the Zubov with my amateur radio callsign RAEM/mm. This is great! In the evening at 2100 hours (midnight Moscow time) I went to the radio cabin to listen around?. I tuned the transmitter power up to one kilowatt in the middle of the twenty metre band. My first CQ went unanswered. After a minute on this frequency I heard a call from a Swiss - HB9AMF. I called him, he answered. Geneva was hearing us at RST 599! Then contacts were made one after another: with Italians, four Americans, a Spaniard, a Frenchman, with radio amateurs from the islands of Guadeloupe and Curacao. Most of them wished me happy sailing. One American demanded whether or not I am president of our amateur radio society.



QSL from RAEM

Printed on back: "Krenkel standing next the sleigh with the radio station before the going to Tayimir (February 19, 1938)." Photo by Chalip. Arctic exploration, Soviet, revolution, socialist, transportation. Grade II

29 November. Every evening I would work right in the middle of the band. Amateurs knew what frequency I was always on.

A.A. Losev - radio manager of the Zubov tunes up the transmitter, Karassev (watch radio operator) is on one side of me with a parallel link and safeguards me, since there is such a din on the air from radio amateurs, that one can sometimes miss callsigns. I got to know Karassev in his absence. He was a keen radio ham and sent me long lists of his QSOs from Franz Josef Land while I filled in QSL-cards* for him in Moscow.

The airwaves rang out, it was necessary to turn down the receiver. The first contact was with a German from the FRG, then five Americans. One of them, K9CLO, said that he had already worked me several years ago. A YL called me - WA3HUP**. I said that she was my first contact with a YL from the Zubov. The last contact was with an Italian from the island of Sicily.

3 December. At eleven o'clock a ceremony was announced, that Neptune, the ruler of all the seas, had come on board. Having been installed on the throne, Neptune asked of Captain Petr Ivanovich Tairov in a loud voice, with an amplifying megaphone: "Who is there, where are you going?" The captain according to form reported and held out a large scroll with the surnames of everyone on the ship.

And although he was the only man not subject to 'baptism', our dear Petr Ivanovich, himself jumped into the salt font in order to inspire good spirits.

A 'baptism' conveyor-belt quickly started up. Devils picked up the next in turn and they were thrown into the pool. The faint-hearted tried to hide in their cabins, but the ubiquitous devils dragged them out. The orchestra served its full repertoire on the mass.

And so, our ship crossed the equator. Neptune admitted us into the Southern hemisphere.

6 December. About three o'clock in the morning I went to the radio cabin. I made a successful catch of our amateurs. At first I only answered Americans but then came calls from Krasnovodsk, Novosibirsk, Perm, Chardzhou, Sverdovsk (here worked my old friend Portnyagin - UA9CC), Zaporozh, Rostov, Kharkov, Erevan and Crimea. All had good audibility. A pile of amateurs called me, two - three people simultaneously. It is a pity that there was insufficient time to contact them all.

8 December. At three o'clock at night, as a rule, radio amateurs come on the air on my watch. Today conditions are such that nothing is heard of our hams. Though, all the same, towards the very end I picked up two home DX stations from Blagoveshensk and Magadan. Those are perhaps the most distant contacts for the present.

RAEM was the call of S/S Cheluskin smashed by ice in the Polar sea in 1934. I was there the chief operator. Since then RAEM is my personal amateur call. Mail address: Ernst Krenkel, Chapligin street, 1/A, Moscow, USSR.

Г 313469 6/VI 1960 г. Типография ГЭИ. Москва, Шлюзовая наб., 10. Зак. 237.

Back Side of QSL RAEM

10 December. I missed some of my watch, but all the same the catch was quite good. A regular DX-contact with Petropavlovsk-on-Kamchatka, and what is more a meeting with A.F. Kamalyagin from Kuibyshev. N.N. Stromilov replied as arranged, but he was heard so weak that nothing was understood.

13 December. Yesterday at 1600 we passed Cape of Good Hope. On the horizon, barely glimpsed and discerned, was a large flat mountain in cloud.

In the morning I was on short-wave. One American paid me a splendid compliment, with which I could by rights be proud of: "For us Americans, RAEM signifies Russia!"

23 December. In the morning I worked on short-wave. As always it was brim-full of Americans. Then Uruguayan CX4CO called me at great strength. He also heard me at maximum strength. We talked very nicely for half an hour. He reported, that he had my QSL card, we had worked each other in 1947! I well remember this contact since it was big DX for me. This radio amateur sometimes worked with the callsign CX1CX.

26 December. From morning we began to enter already very solid ice.

In two hours they announced on the speaker - Ob was on the horizon, but she only approached us by eight in the evening. Ob forced a channel, and we slowly crept through it. On the horizon was an entire barrier of icebergs. We counted 20 pieces, but there were most likely more of them. Here there was no tired sun. It was not up. This was mighty white grandeur - unforgettable.

1 January 1969. So then, Antarctica appeared before us as a white dome. Below, a barely visible black spot, Mirny was revealed. Both ships cut into the fast shore ice. Two Landrovers hastily came running. Penguins also hastily approached to make everything out. A ladder was lowered. On the ice the first messages are transmitted - greetings from the Big Land.

6 January. Karassev arrived and said that band conditions for our radio amateurs were tremendous and that ten men were already lined up in turn. The air really teemed. I made communications with Rekach and Stromilov.

12 January. Ob set about unloading. For four days the flagship punched a channel in the huge field of fast shore ice up to the safe ice, where we could work the tractors.

UPOL-1: Ice Polar Station, 1937

Zubov stands aside, waiting its turn to enter the four-kilometre channel. Seventy men are already on the shore. On shoulders, on buck-rakes, very delicate instruments are dragged four kilometres, since even light Landrovers are hindered in snow saturated with water. Further from the Ob it is a difficult journey: twenty kilometres more with zigzags, with evasion, eight bridges.

Relief arrives on the Zubov for the old winterers. There are sunburnt faces with white circles from dark goggles around the eyes. The weather allowed two aircraft trips to take out seven polyarniks from the very arduous Vostok station.

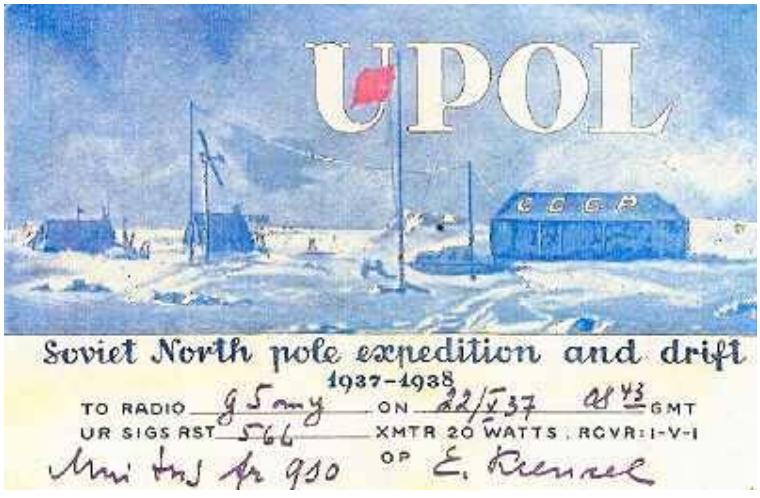
The eighth was a ceremonial day - the lowering of the flag of the thirteenth and the raising of the flag of the fourteenth Soviet Antarctic Expedition. The two heads, Shamontev and Maksutov, conducted a solemn ceremony in the presence of personnel from both expeditions.

The roof of the radio centre served as a rostrum adorned with flags of the States with polar stations in Antarctica.

Radio centre, diesel, and some office buildings are well positioned and not covered with snow. Others have less luck: hopelessly concealed by a snow covering four-five metres thick.

In the centre of the large settlement is the famous post with indicators - how many kilometres to the base capitals of the world. Yes, they are a long way off! A second post confirms that Mirny is right on the antarctic circle.

Forcibly puffing, clambering along an ice ravine created by human hand, is the next tractor. Flocks of penguins rushed to its noise, seals just lazily raised their heads. The Zubov took on board nearly all the old relief polyarniks.



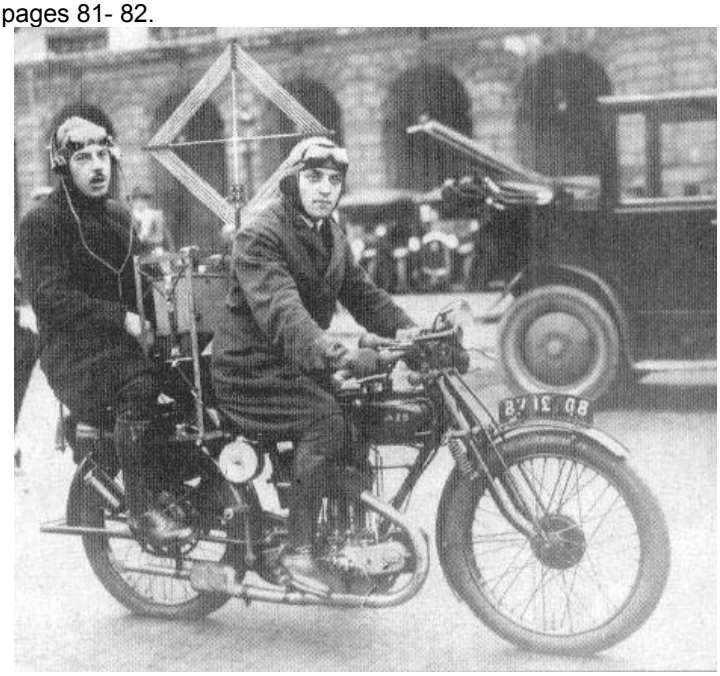
Application for HF- VHF radio station

History goes away out of us… We lost in time papers, things and may be something else. That is why ***AntenTop*** published some old papers, old schematics, old photos.

At this stuff you can see a copy of application on a radio-station. This application was used from 1965 (?) till 1995 (?) in the USSR, then in Russia.

Why (?) ask you me? Because somebody told me that first date was 1964, another person told me that first date should be 1969. I do not know exactly. It is in history.

Below you can see translation the application, scan of original paper is on the pages 81- 82.



USSR. 30's of the 20 century. Moto- Radio (Credit Line: www.cqham.ru)

Application for HF- VHF radio station

I ask to permit installation and operation of a private HF- VHF- radio station.

I inform on myself the following information.

1. Place and date of birth
2. Sex
3. Nationality
4. Social origin
5. Profession
6. Social status
7. Belong to party. (in the USSR there was only one party – CPSU – Communist Party of Soviet Union)
8. Education
9. Have you been abroad?
10. I know (poorly, good) language
11. Have you been in captivity (where, when, how you was captivated and when did you released from captivities)
12. Have you been in territory temporarily occupied by German during ww2 (where, when. Also what was your job at this time)?
13. Your duties to a military service
14. Have you been under law-court?
15. I have penalty upon CPSU (for members of CPSU).
16. Last place of job
17. Marital status
18. Registration (Where are you live?)
19. Passport data

I offer to make a HF- VHF radio station for experimental with radio amateurs. Data of the radio station.

1. Type and circuit of the transmitter
2. Power of the transmitter
3. Stabilization of frequency
4. Modulation
5. Number of cascades of the transmitter
6. Range of waves of the transmitter
7. Kind of the receiver

73! I.G.

Разрешение № _____ на эксплуатацию _____
Министерство Связи

радиостанции Гр. _____

Выдано _____ 198 __ г. _____

проживающего в г. _____

по ул. _____

ЗАЯВЛЕНИЕ-АНКЕТА

Прошу разрешить установку и эксплуатацию коротковолновой-ультракоротковолновой радио-станции индивидуального пользования.

Сообщаю о себе следующие сведения:

1. Место, год и месяц рождения _____
2. Пол. _____ 3. Национальность _____ 4. Социальное происхождение _____ 5. Основная профессия _____
6. Социальное положение _____
7. Партийность _____
8. Образование _____
9. Был за границей _____ с _____ по _____
10. Знаю (слабо, хорошо) язык _____
11. Был в плену (где, когда, при каких обстоятельствах попал, и когда освободился из плена) _____
12. Находился на территории, временно оккупированной немцами в период Отечественной войны (где, когда и работа в это время) _____
13. Отношение к воинской обязанности _____
14. Привлекался к судебной ответственности и решение _____
15. Имею партвзыскания _____
16. Последнее место работы _____ 17. Семейное положение _____
18. Прописан постоянно (временно) с _____
19. Паспорт серия _____ № _____ выдан _____

Я предлагаю построить коротковолновую-ультра коротковолновую радиостанцию для проведения экспериментальной работы радиолюбителями по следующим данным:

1. Тип и марка (схема) передатчика _____
2. Номинальная мощность передатчика _____
3. Стабилизация _____
4. Модуляция _____
5. Число каскадов передатчика _____
6. Диапазон волн передатчика _____
7. Тип и марка приемника _____

С инструкцией о порядке регистрации и эксплуатации любительских приемно-передающих радиостанций индивидуального и коллективного пользования ознакомлен и обязуюсь строго ее выполнять.

«____» _____ 198 __ г. **Подпись** _____

Тов. _____ сдал _____

«____» _____ 198 __ г. квалификационной комиссии _____

_____ радиотехнической школы ДОСААФ испытание по программе _____

_____ категории с оценкой: _____

1. Электро-радиотехника _____ 2. Техника безопасности _____

3. Прием на слух буквенного текста _____ знаков в минуту

цифрового _____ _____ знаков в минуту, передача буквенного

текста _____ знаков в минуту, передача цифрового

текста _____ знаков в минуту.

Тов. _____ по своим знаниям и опыту работы может

эксплуатировать радиостанцию _____ категорию индивидуального

пользования.

ПРЕДСЕДАТЕЛЬ КВАЛИФИКАЦИОННОЙ КОМИССИИ

НАЧАЛЬНИК _____ РАДИОТЕХНИЧЕСКОЙ ШКОЛЫ

«____» _____ 198 __ г.

Решение Государственной инспекции электросвязи о целесообразности установки _____

_____

_____

_____

Регистрационный взнос оплачен в сумме _____ руб.

квитанция № _____ от _____ 198 __ г.

Инженер Государственной инспекции электросвязи

Борисовская типография з. 217 т 500 4.1. 85 г.

Russian Receiver R-311

R311 – “Portable” tube military HF receiver intended for range 1.0 – 15.0 MHz. The receiver has 5 sub bands. A retuned filter is used in IF tract. R311 can be fed by to 2 x 1.2-V heavy- duty NiCad accumulators (through internal vibropack). Mine R- 311 was fed by main through a home made external PSU. R- 311 receives AM, CW and SSB.

R- 311s were produced from the beginning of 50 (from 1952??) till end of 1970. However, I have seen R- 311 with label “1982.” Receivers made from beginning of 70s have tight vernier. It can be fixed by loosing screws in the vernier.

R- 311 were used at a radio- intelligence division. Then it was widely used in USSR Army- in tank, in ship, like army headquarter monitoring receiver for receiving routine radiogram, weather forecast, like military training receiver, etc. The receiver works well both with short and long antennas. R- 311 practically has no rustle without an antenna.

Usual malfunction of the receiver is a bad contact in the band’s switch. High level of noise, excitation on one or several bands, losses of sensitivity on one or several bands- all of this it is bad contact(s). Treatment- cleaning the contacts by rubber or cleaning liquid (like WD- 40). However, as usual, for R-311 produced from beginning of 70s it gives short term effect for 6-12 month, then you need clean the contacts again.

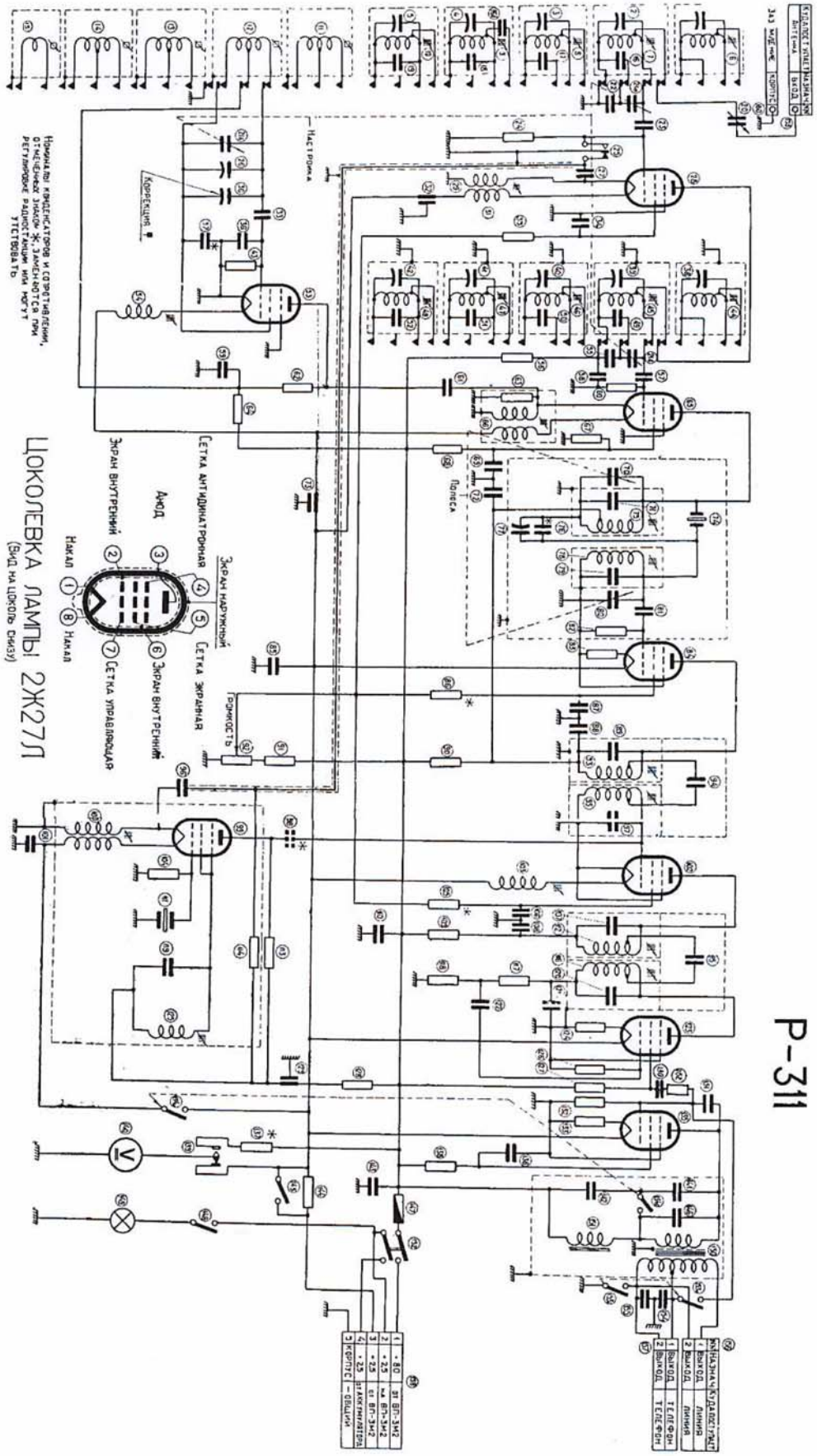
(See schematic diagram on page 84)

R- 311 at my home in Belgorod, please, notice, accumulator’s box was cut from the receiver.

Credit Line: www.cqham.ru

The tubes in the R-311 are very reliable they go out of operation very seldom. The most reliable R- 311s was produced between 1958- 1965.

Mine R- 311 was produced in 1958, this one work at my shack from 1980- till 2004, sometimes 24/7. I never change its tubes made in 1958.


ЦОКОЛЕВКА ЛАМПЫ 2Ж27П
(ВИД НА ЦОКОЛЬ СНИЗУ)
Накал
Экран внутренний
Анод
Сетка антидинатронная
Экран наружный
Сетка экранная
Сетка управляющая
Экран внутренний
Накал
Настройка
Коррекция
Полоса
Громкость
Р-311

Russian Receiver R-326

R326 – “Portable” tube military HF receiver intended for range 1.0 – 20.0 MHz. The receiver has 6 sub bands. A retuned filter is used in IF tract. R326 can be fed or by to two 1.2-V heavy- duty accumulators (anode fed through internal converter DC/DC) or by main through external PSU unit. R- 326 receives AM, CW and SSB.

R- 326s were produced from the end of 50 (from 1956??) till end of 1970. I have seen R- 326 with label “1978.” Receivers made after end of 60s have tight vernier. It can be fixed by loosing screws in the vernier.

R- 326 were used at a radio- intelligence division. Also was used like army headquarter monitoring receiver for receiving routine radiogram, weather forecast, etc. The receiver works well only with a short antennas, no more the 3 meters long. Long antenna blocks the receiver. R- 326 corresponds its military nick name- SHOROH (“Rustle” in English). Receiver has very high level of rustle even without an antenna.

(See schematic diagram on pp.: 86, 87, 88)

R- 326 with Antenna

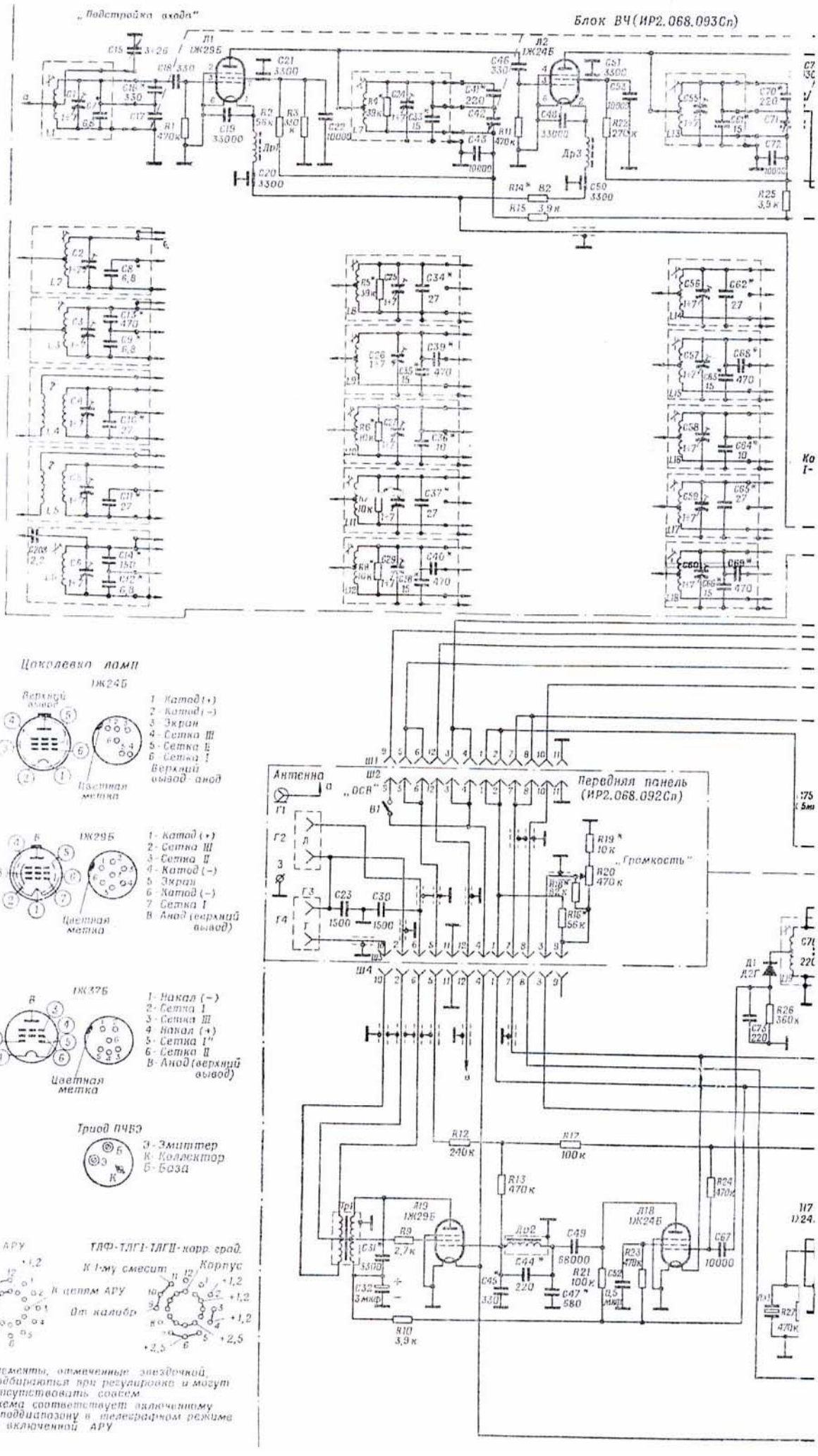
Credit Line: www.cqham.ru http://www.oldradioclub.ru/

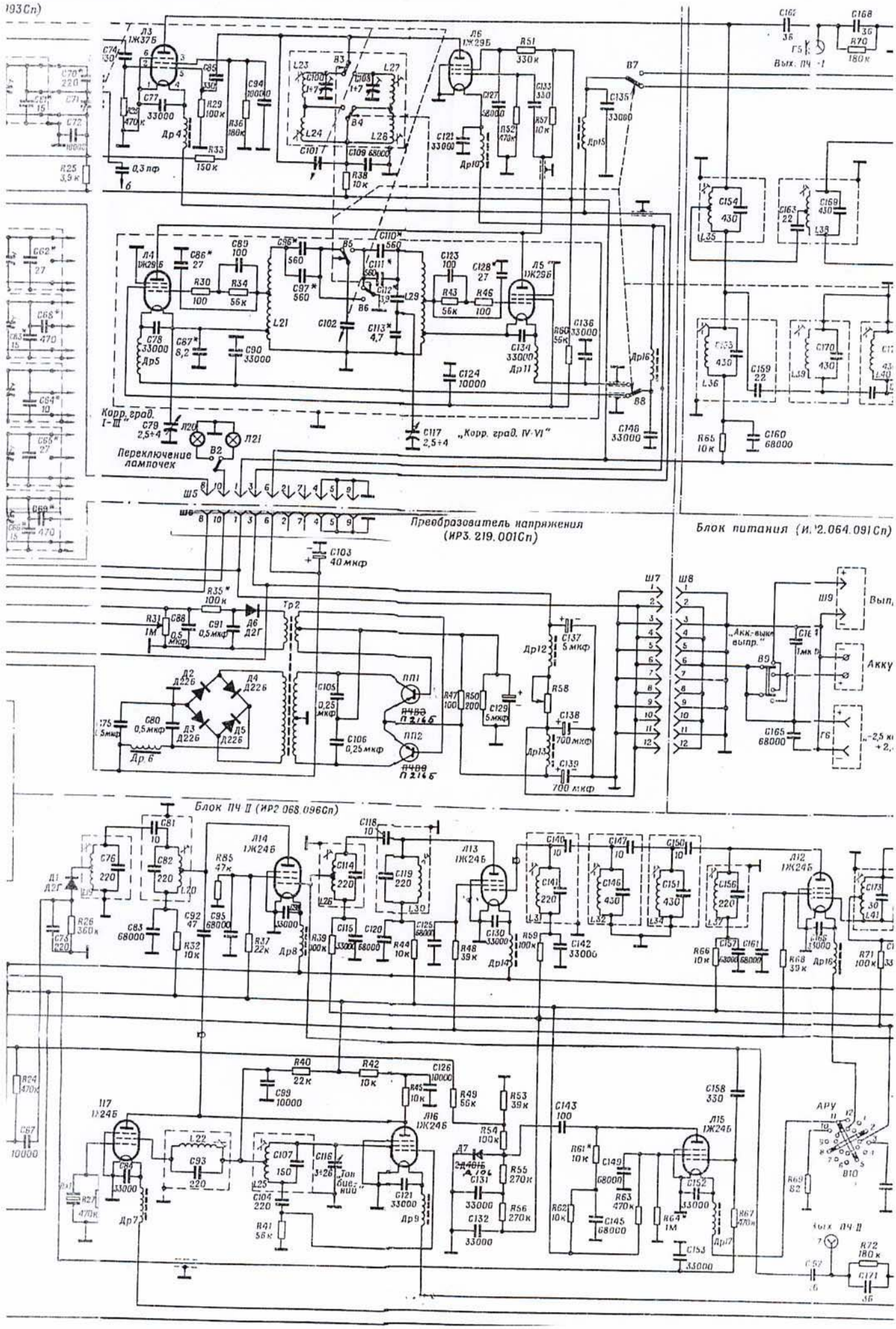
Usual malfunction of the receiver is a bad contact in the band’s switch. High level of noise, excitation on one or several bands, losses of sensitivity on one or several bands- all of this it is bad contact(s). Treatment- cleaning the contacts by rubber or cleaning liquid (like WD- 40), however as usual it gives short term effect for 6-12 month, then you need clean the contacts again. The tubes in the R-326 are very reliable they go out of operation very seldom. Sometimes replacement of old tubes by new ones gives significant decreasing of the noise. But it takes time and hard to do. The most reliable R- 326s were produced between 1965- 1970.

R- 326 rear view, with PSU

R- 326 with PSU and Manual

Quick Manual for R- 326 (at cover)


„Подстройка входа"
Блок ВЧ (ИР2.068.093Сп)
Цоколевка ламп
1Ж24Б
Верхний вывод
Цветная метка
1 Катод (+)
2 Катод (–)
3 Экран
4 Сетка III
5 Сетка II
6 Сетка I
Верхний вывод – анод
1Ж29Б
1 Катод (+)
2 Сетка III
3 Сетка II
4 Катод (–)
5 Экран
6 Катод (–)
7 Сетка I
8 Анод (верхний вывод)
1Ж37Б
1 Накал (–)
2 Сетка I
3 Сетка III
4 Накал (+)
5 Сетка I"
6 Сетка II
8 Анод (верхний вывод)
Триод П416
Э Эмиттер
К Коллектор
Б База
Антенна
„ОСВ"
Передняя панель (ИР2.068.092Сп)
„Громкость"
АРУ
ТЛФ-ТЛГ1-ТЛГII-корр. град.
К 1-му смесит.
Корпус
К цепям АРУ
От калибр.
1 Элементы, отмеченные звездочкой, подбираются при регулировке и могут отсутствовать совсем.
2 Схема соответствует включению I поддиапазона в телеграфном режиме с включенной АРУ


Л3 1Ж37Б
Л6 1Ж29Б
Л4 1Ж29Б
Л5 1Ж29Б
Корр. град. I-III
Переключение лампочек
„Корр. град. IV-VI"
Ш5
Ш6
Преобразователь напряжения (ИРЗ. 219. 001Сп)
Блок питания (И.12.064.091Сп)
Ш7
Ш8
Ш9
Блок ПЧ II (ИР2 068.096Сп)
Л14 1Ж24Б
Л13 1Ж24Б
Л12 1Ж24Б
Л17 1Ж24Б
Л16 1Ж24Б
Л15 1Ж24Б
Вых. ПЧ-1
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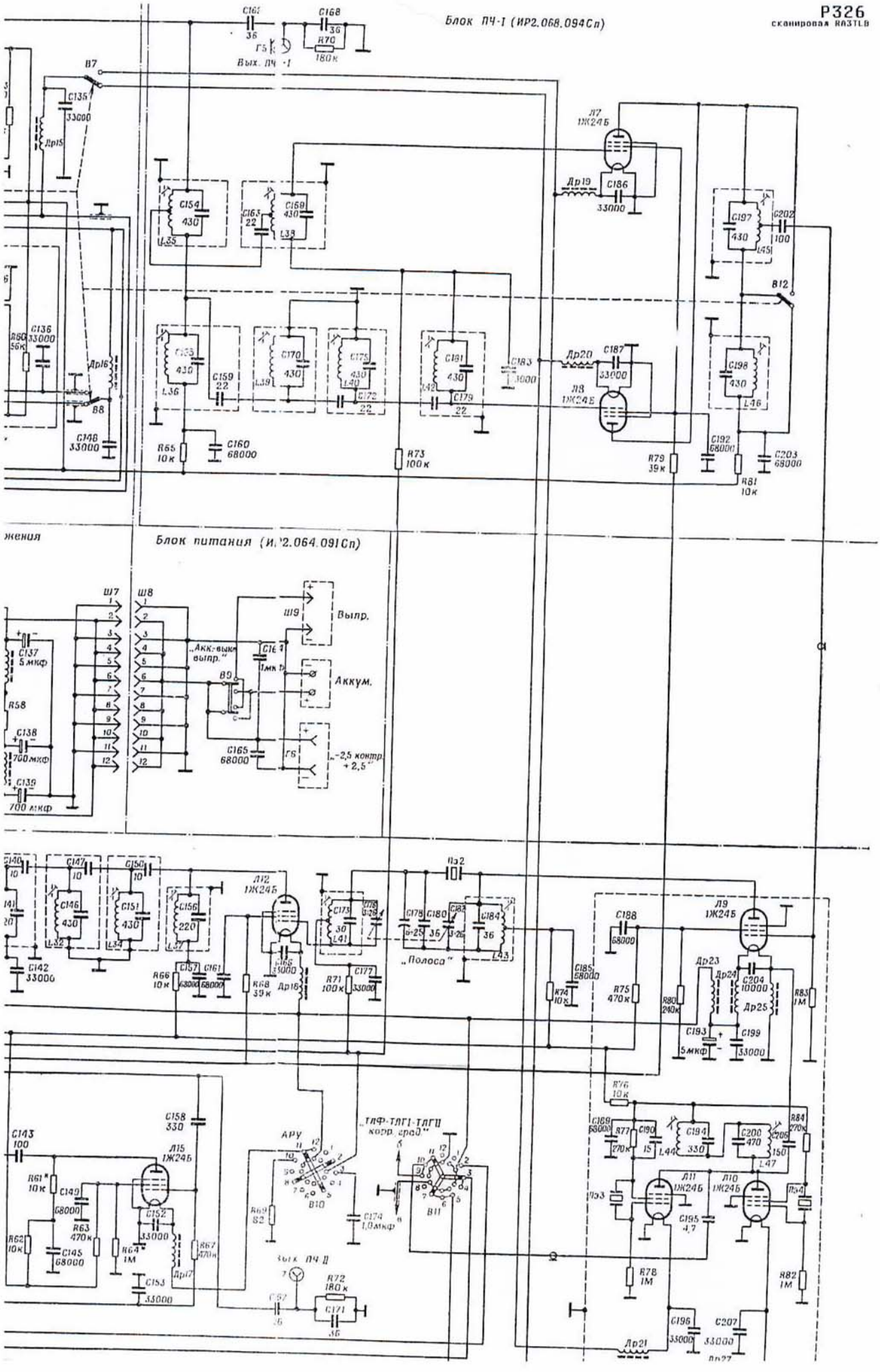
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Аккум.
„Полоса"
АРУ
„ТЛФ-ТЛГ1-ТЛГII корр. град."
Вых. ПЧ II

TV Channels and Frequencies

Just List of frequencies/Channels used by NTSC TV

Channel #	Freq. MHz	Channel #	Freq. MHz	Channel #	Freq. MHz
VHF Low Channels		29	560-566	59	740-746
1*	44-50**	30	566-572	60	746-752
2	54- 60	31	572-578	61	752-758
3	60-66	32	578-584	62	758-764
4	66-72	33	584-590	63	764-770
5	76-82	34	590-596	64	770-776
6	82-88	35	596-602	65	776-782
7	174-180	36	602-608	66	782-788
8	180-186	37	608-614	67	788-794
9	186-192	38	614-620	68	794-800
10	192-198	39	620-626	69	800-806
11	198-204	40	626-632	70	806-812
12	204-210	41	632-638	71	812-818
13	210-216	42	638-644	72	818-824
UHF Channels		43	644-650	73	824-830
14	470-476	44	650-656	74	830-836
15	476-482	45	656-662	75	836-842
16	482-488	46	662-668	76	842-848
17	488-494	47	668-674	77	848-854
18	494-500	48	674-678	78	854-860
19	500-506	49	680-686	79	860-866
20	506-512	50	686-692	80	866-872
21	512-518	51	692-698	81	872-878
22	518-524	52	698-704	82	878-884
23	524-530	53	704-710	83	884-890
24	530-536	54	710-716	*Channel #1 not used ** Video Carrier: Low Edge +1.25 MHz, Audio Carrier: Upper Edge - .25 MHz, i.e., Video Ch1 is 45.25 MHz, Audio Ch1 is 49.75 MHz	
25	536-542	55	716-722		
26	542-548	56	722-728		
27	548-554	57	728-734		
28	554-560	58	734-740		

Some channels may be offset 10 kHz to prevent mutual interferences

FM Radio Channels and Frequencies

Just List of frequencies/Channels used by FM Radio

Channel #	Freq. MHz	Channel #	Freq. MHz	Channel #	Freq. MHz
1	88.10	35	94.90	69	101.70
2	88.30	36	95.10	70	101.90
3	88.50	37	95.30	71	102.10
4	88.70	38	95.50	72	102.30
5	88.90	39	95.70	73	102.50
6	89.10	40	95.90	74	102.70
7	89.30	41	96.10	75	102.90
8	89.50	42	96.30	76	103.10
9	89.70	43	96.50	77	103.30
10	89.90	44	96.70	78	103.50
11	90.10	45	96.90	79	103.70
12	90.30	46	97.10	80	103.90
13	90.50	47	97.30	81	104.10
14	90.70	48	97.50	82	104.30
15	90.90	49	97.70	83	104.50
16	91.10	50	97.90	84	104.70
17	91.30	51	98.10	85	104.90
18	91.50	52	98.30	86	105.10
19	91.70	53	98.50	87	105.30
20	91.90	54	98.70	88	105.50
21	92.10	55	98.90	89	105.70
22	92.30	56	99.10	90	105.90
23	92.50	57	99.30	91	106.10
24	92.70	58	99.50	92	106.30
25	92.90	59	99.70	93	106.50
26	93.10	60	99.90	94	106.70
27	93.30	61	100.10	95	106.90
28	93.50	62	100.30	96	107.10
29	93.70	63	100.50	97	107.30
30	93.90	64	100.70	98	107.50
31	94.10	65	100.90	99	107.70
32	94.30	66	101.10	100	107.90
33	94.50	67	101.30		
34	94.70	68	101.50		

One Coil Loop

Hams often use One Turn Loop (**Figure 1**) in their homebrewing. Such Loop may be used in a transmitting/receiving HF- VHF Magnetic Loop Antenna (**Figure 2**), in a simple VHF oscillator working on transmitting without antenna (**Figure 3**), in receiving VHF antenna for simple VHF receiver (**Figure 4**).

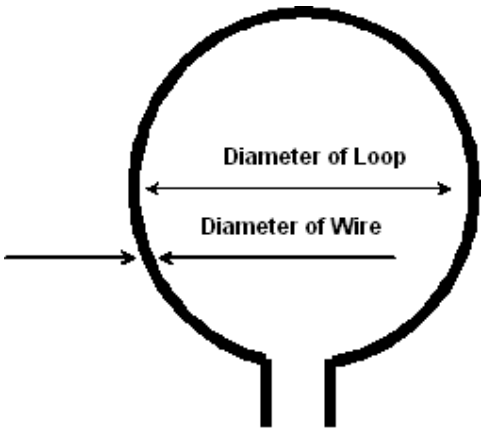

Figure 1
One Turn Loop

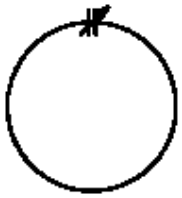

Figure 2
Magnetic Loop

The knowledge of inductance of the One Turn Loop allows to design these devices easy. You can find the inductance of a round One Turn Loop from the diagrams given in **Figure 5**. When you know the inductance of the loop you may find parameters of the resonator tank (loop plus capacitor).

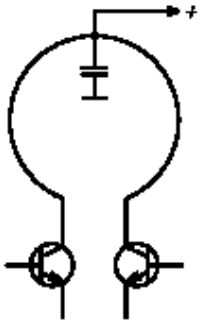

Figure 3
Simple VHF oscillator

You may use the diagram given on **Figure 5** for calculation of the Insulation RF Choke (**Figure 6**). The inductance of that RF Choke approximately is a sum of the inductance of turns forming the choke. Example: One Turn Loop has inductance 1 μHn. Coil formed by five such turns has inductance 5 μHn.

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Igor Grigorov.
Antenny. Nastroyka I Soglasovanie.
(In Russian)

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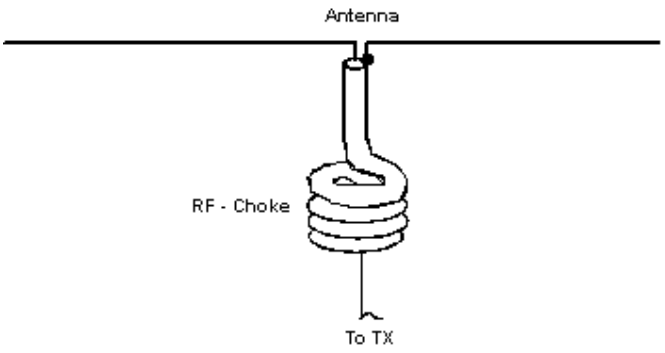

Figure 6
Insulation RF Choke

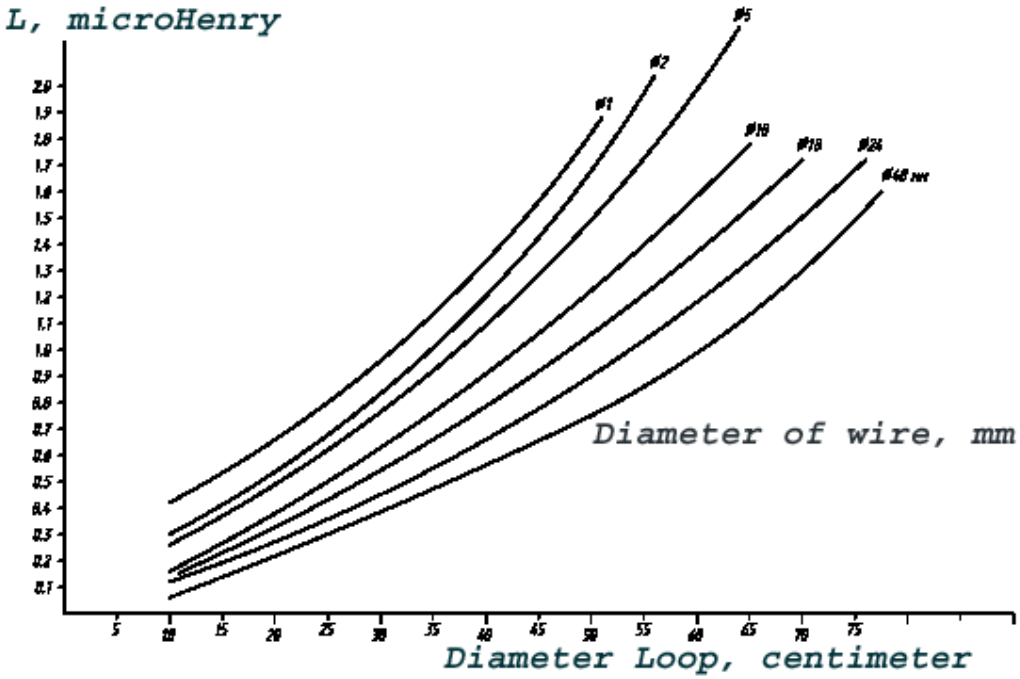

Figure 5
Inductance of One Turn Loop Vs Diameter

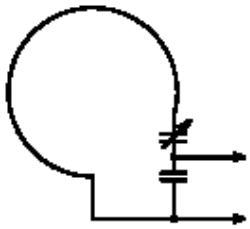

Figure 3
Receiving VHF antenna

Antennas for Radio Amateurs: by Igor Grigorov, RK3ZK

In Russian

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Inductor Data

It is easy to find the inductance of an inductor using equation shown on **Figure 1**. However, very often ham use for implementation of the inductor some normalized forms. So, it is possible to do tables that are contained data for such forms.

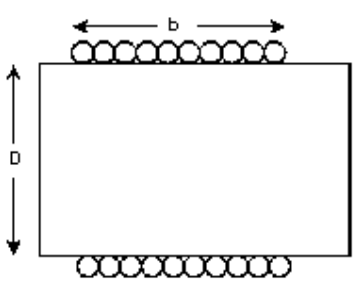
Table 1 (Reference 1) contains data for inductor coiled on a form in 18 and 20 mm diameter. L – length in mm, N- numbers of turns.

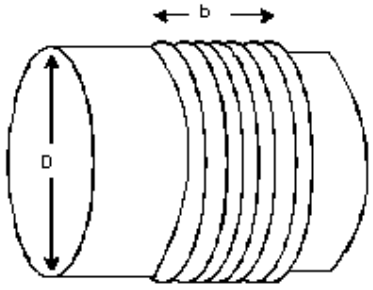
Example: Inductor coiled on the form in 18 mm diameter by 10 turns on length 20 mm has inductance 1.153-μHn.

Table 2 (Reference 1) contains data for inductor coiled on a form in 25 AND 30mm diameter. L – length in mm, N- numbers of turns.

Example: Inductor coiled on the form in 30 mm diameter by 10 turns on length 20 mm has inductance 2.687-μHn.

Table 3 (Reference 1) contains data for inductor coiled on a form in 40 and 50mm diameter. L – length in mm, N- numbers of turns.





$b > \frac{D}{2}$ $L = \frac{0.2\,D^2\,n^2}{9D + 20b}$

$b < \frac{D}{2}$ $L = \frac{0.1\,D^2\,n^2}{4D + 11b}$

L- μHn

b- length, centimetres

D- diameter, centimetres

n- number of turns

Figure 1

Table 1

N \ L	Diameter 18 mm					Diameter 20 mm				
	5	10	15	20	25	5	10	15	20	25
5	**0.618**	**0.448**	**0.351**	**0.288**	**0.245**	**0.714**	**0.526**	**0.417**	**0.345**	**0.294**
10	**2.473**	**1.790**	**1.403**	**1.153**	**0.979**	**2.857**	**2.105**	**1.667**	**1.379**	**1.176**
15	**5.565**	**4.028**	**3.156**	**2.594**	**2.202**	**6.429**	**4.737**	**3.750**	**3.103**	**2.647**
20	**9.893**	**7.160**	**5.610**	**4.612**	**3.915**	**11.43**	**8.421**	**6.667**	**5.517**	**4.706**
30	**22.26**	**16.11**	**12.62**	**10.38**	**8.81**	**25.71**	**18.95**	**15.00**	**12.41**	**10.59**
50	**61.83**	**44.75**	**35.06**	**28.83**	**24.47**	**71.43**	**52.63**	**41.67**	**34.48**	**29.41**

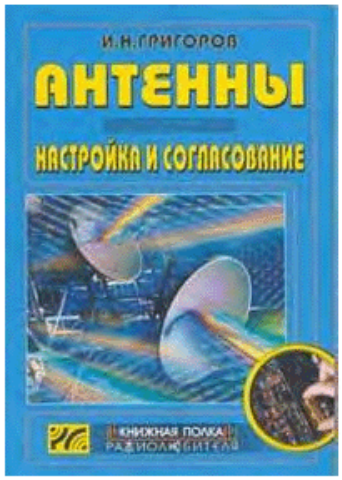
Inductor Data

Table 2

N \ L	Diameter 25 mm					Diameter 30 mm				
	10	20	30	40	50	10	20	30	40	50
5	0.735	0.500	0.379	0.305	0.255	0.957	0.672	0.517	0.421	0.354
10	2.941	2.00	1.515	1.220	1.020	3.83	2.687	2.069	1.682	1.417
15	6.618	4.50	3.409	2.744	2.296	8.617	6.045	4.655	3.785	3.189
20	11.76	8.00	6.061	4.878	4.082	15.32	10.75	8.276	6.729	5.669
30	26.47	18.00	13.64	10.98	9.184	34.47	24.18	18.62	15.14	12.76
50	73.53	50.00	37.88	30.49	25.51	95.74	67.16	51.72	42.06	35.43

Table 3

Q \ L	Diameter 40 mm					Diameter 50 mm				
	10	20	30	40	50	10	20	30	40	50
5	1.429	1.063	0.833	0.690	0.588	1.923	1.471	1.190	1.00	0.862
10	5.714	4.211	3.333	2.759	2.353	7.692	5.882	4.762	4.000	3.448
15	12.86	9.474	7.500	6.207	5.294	17.31	13.24	10.71	9.000	7.759
20	22.86	16.84	13.33	11.03	9.412	30.77	23.53	19.05	16.00	13.79
30	51.43	37.89	30.00	24.83	21.18	69.23	52.94	42.86	36.00	31.03
50	142.9	105.3	83.33	68.97	58.82	192.3	147.1	119.0	100.0	86.21



Reference 1

Igor Grigorov.
Antenny. Nastroyka I Soglasovanie.
(In Russian)

Publishing House RadioSoft,

Moscow, 2002

Inductor Data

Table 4 (Reference 2) contains data for inductor coiled on a form in 30 and 30 mm diameter. L – length in mm, N- numbers of turns.

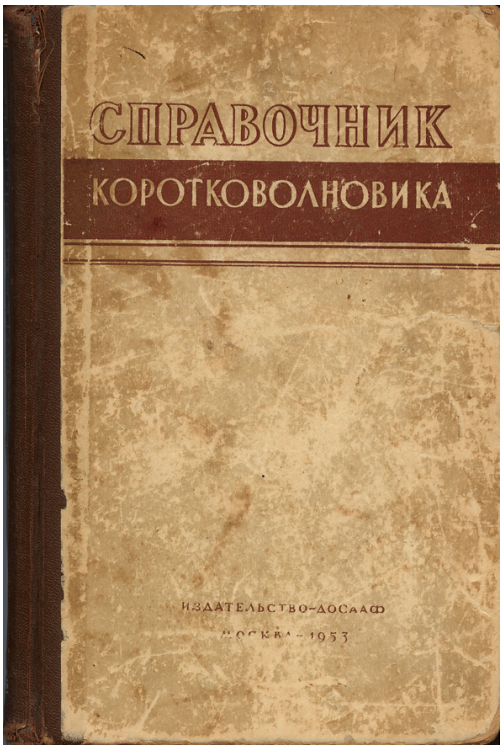
Table 5 (Reference 2) contains data for inductor coiled on a form in 50 mm diameter. L – length in mm, N- numbers of turns.

Table 4

N \ L	Diameter 20 mm					Diameter 30 mm				
	4	7	10	15	24	6	10.5	15	22.5	36
2	0.128	0.100	0.080	0.064	0.048	0.192	0.150	0.120	0.096	0.072
3	0.288	0.225	0.180	0.144	0.108	0.432	0.338	0.270	0.216	0.162
4	0.512	0.400	0.320	0.256	0.192	0.770	0.600	0.480	0.385	0.288
5	0.800	0.625	0.500	0.400	0.300	1.200	0.940	0.750	0.600	0.450
6	1.150	0.900	0.720	0.575	0.430	1.720	1.350	1.080	0.860	0.645
7	1.570	1.225	0.980	0.785	0.590	2.350	1.840	1.470	1.175	0.885
8	2.050	1.600	1.280	1.025	0.770	3.080	2.400	2.070	1.540	1.155
9	2.590	2.025	1.620	1.295	0.970	3.900	3.050	2.430	1.920	1.455
10	3.200	2.500	2.000	1.600	1.200	4.800	3.750	3.000	2.400	1.800
12	4.600	3.600	2.880	2.300	1.720	6.900	5.400	4.320	3.450	2.580
14	6.300	4.900	3.920	3.150	2.360	9.450	7.350	5.900	4.700	3.550
16	8.200	6.400	5.120	4.100	3.070	12.30	9.600	7.700	6.150	4.600
18	10.400	8.100	6.500	5.200	3.900	15.60	12.15	9.750	7.800	5.850
20	12.800	10.00	8.000	6.400	4.800	19.20	15.00	12.00	9.600	7.200
25	20.00	15.60	12.50	10.00	7.500	30.00	23.40	18.80	15.00	11.25
30	28.00	22.50	18.00	14.40	10.80	43.20	33.80	27.00	21.60	16.20
35	39.20	31.20	24.60	19.60	14.70	59.00	45.50	36.50	29.50	22.00
40	51.200	40.00	32.00	25.60	19.20	77.00	60.00	48.00	38.50	28.80
45	65.100	50.50	40.50	32.50	24.30	97.50	76.00	61.00	48.80	36.50
50	80.00	62.50	50.00	40.00	30.00	120.0	94.00	75.00	60.00	45.00
60	115.00	90.00	72.00	57.50	43.00	172.0	135.0	108.0	86.00	64.50

Table 5

N \ L	Diameter 50mm				
	10	17.5	25	37.5	60
2	0.320	0.250	0.200	0.160	0.120
3	0.720	0.560	0.450	0.360	0.270
4	1.280	1.000	0.800	0.640	0.480
5	2.00	1.570	1.250	1.000	0.750
6	2.880	2.250	1.800	1.440	1.075
7	3.920	3.070	2.450	1.960	1.480
8	5.140	4.000	3.200	2.570	1.930
9	6.480	5.050	4.050	3.240	2.430
10	8.000	6.250	5.000	4.000	3.000
12	11.50	9.000	7.200	5.750	4.300
14	16.50	12.30	9.800	7.800	5.900
16	20.50	16.00	12.80	10.25	7.650
18	26.00	20.30	16.30	13.00	9.800
20	32.00	25.00	20.00	16.00	12.00
25	50.00	39.00	31.50	25.00	18.80
30	72.00	56.00	45.00	36.00	27.00
35	98.00	77.00	59.00	49.00	37.00
40	128.0	100.0	80.00	64.00	48.00
45	163.0	127.0	100.0	81.50	61.00
50	200.0	157.0	125.0	100.0	75.00
60	288.0	225.0	180.0	144.0	107.00



Reference 2

F. Burdeynyj, N. Kazanskiy, A. Kamalyagin, K. Shulgin

Spravochnik Korotkovolnovika
(Ham Handbook)
(In Russian)

DOSAAF,
Moscow, 1953

Lightning Tank Calculator

Very often an amateur need calculate parameters of resonator tank (see **Figure 1**). Certainly, there are lots programs that can do the calculations. However very quick and with acceptable tolerance amateur can do it using **Table 1**. The table gives value for L (in µHn) multiple to C (in pF).

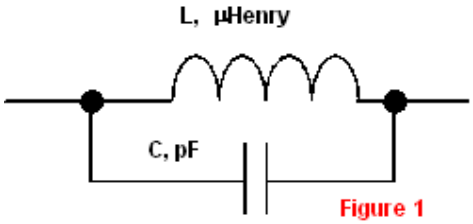


Figure 1

Example 1: You need resonator tank for 10 MHz. Value LxC is 253.3.

So, you may use, L= 2.53 µHn and C= 100 pF. 2.53X100= 253.

Or, you may use L= 5 µHn and C= 56.6-pF. 5X56.6= 253.

Subtract from the capacitance 10- 15 pF- it is selfcapacitance L plus capacitance parts to ground. So, real C should be 238 pF(253- 15) or 41 pF (56- 15).

Example 2: You need resonator tank for 14 MHz. Value LxC is 129.2.

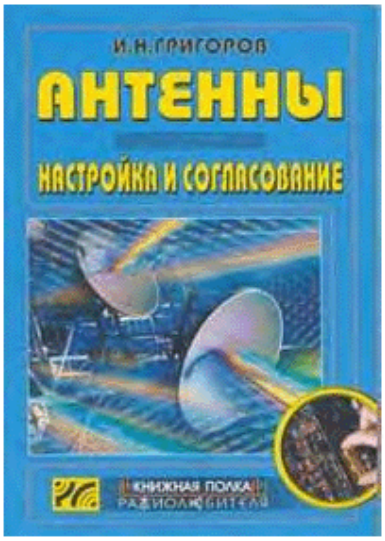
So, you may use, L= 1.0-µHn and C= 129 pF. 1.0X129= 129.

Or, you may use L= 2 µHn and C= 64.6-pF. 2X64.6= 129,2.

Subtract from the capacitance 10- 15 pF- it is selfcapacitance L plus capacitance parts to ground. So, real C should be 114 pF(129-15) or 49 pF (64- 15).

Table 1 LC Value

F, MHz	LC	F, MHz	LC	F, MHz	LC	F, MHz	LC	F, MHz	LC
0.5	101320	1.8	7818	6	703.6	15	112.6	24	43.98
0.6	70361	2.0	6333	7	516.9	16	98.95	25	40.53
0.7	51694	2.5	4053	8	395.8	17	87.65	26	37.47
0.8	39578	3.0	2814	9	312.7	18	78.18	27	34.75
0.9	31272	3.5	2068	10	253.3	19	70.17	28	32.31
1.0	25330	4.0	1583	11	209.3	20	63.33	29	30.12
1.2	17590	4.5	1251	12	175.9	21	57.44	30	28.14
1.4	12923	5.0	1013	13	149.9	22	52.33	31	26.36
1.6	9695	5.5	837.4	14	129.2	23	47.88	32	24.74



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Antenny. Nastroyka I Soglasovanie.
(In Russian)

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Capacitor Code

Ceramic Capacitor may have 3 or 4 numbers at its body. Last number is ***multiplier***. The number tells how much =zeros= contains multiplied number. Numbers before are value in pF.

Example 1: At a capacitor's body is number 102. It means 10-pF multiply to 100 (last number tells us about 2 =zeros=). So, 1000-pF.

Example 2. At a capacitor's body is number 101. It means 10-pF multiply to 10 (last number tells us about 1 =zero=). So, 100-pF.

Example 3: At a capacitor's body is number 103. It means 10-pF multiply to 1000 (last number tells us about 3 =zeros=). So, 10000-pF.

Capacitor that has value in pF may be marked straight away in pF. A letter =p= shows the value.

Example 4: At a capacitor's body is number 5p6. It means 5.6-pF.

Example 5: At a capacitor's body is number 10p. It means 10-pF.

Sometimes, capacitance is marked in 1000-pF. Letter =n= tells about it.

Example 6: At a capacitor's body is number 2n2. It means 2200-pF.

Example 7: At a capacitor's body is number 10n. It means 10000-pF.

Capacitance may be marked in µF. At the case only numbers with point can be found at the body.

Example 7: At a capacitor's body is number = .1=. It means 0.1- µF.

Example 8: At a capacitor's body is number = 3.3=. It means 3.3- µF.

As usual, after numbers follows a letter. The letter may be located under numbers. The letter tells us about ***tolerance***. **Table 1** shows the tolerance code.

Example 9: At a capacitor's body is number 103N. It means 10-pF multiply to 1000 (last number tells us about 3 =zeros=). So, 10000-pF +- 30%.

Example 10: At a capacitor's body is number 2p2B. It means 2.2-pF +- 0.1-pF.

Some capacitors may have mark of ***Temperature Coefficient*** which is marked by different color at cap of the capacitor. ***Table 2*** shows the Color Code for a ***Temperature Coefficient.***

Example 11: At a capacitor's body is number 101. Cap is red. It means 100-pF N080.

Some old capacitors may have Letter Code for dielectric material. ***Table 3*** shows the code.

Table 1 Tolerance Code for Capacitor

Tolerance	+-0.05pF	+-0.1 pF	+-0.25pF	+-0.5pF	+-0.5%	+-1%	+-2%	+-3%	+-5%	+-10%
Tolerance Code	A	B	C	D	E	F	G	H	J	K

Tolerance	+-15%	+-20%	+- 30 %	-0% 100%	-20 +50%	-0 +200%	-20 +40 %	-20 +80%
Tolerance Code	L	M	N	P	S	W	X	Z

Example 12: At a capacitor's body is number =2.2= KP. It means 2.2-µF dielectric Polypropylene Film/Foil.

Figure 1 shows some others examples of Number, Letters and Color Code.

Table 2
Color Code (Cap Mark) for Temperature Coefficient

Black	Brown	Red	Orange	Yellow	Green	Blue
NP0	N030	N080	N150	N220	N330	N470

Violet	Red+ Orange	Orange+ Orange	Yellow+ Orange	Green+ Orange	Blue+ Orange	Red+ Violet
N750	N1000	N1500	N2200	N3300	N4700	P100

Table 3
Letter Code for Dielectric Material

KT	KC	KP	KS	MP	MKP
Polyester Film/Foil	Polycarbonate Film/Foil	Polypropylene Film/Foil	Polystyrene Film/Foil	Metallized Paper	Metallized Polypropylene

MKC	MKT
Metallized Polycarbonate	Metallized Polyester

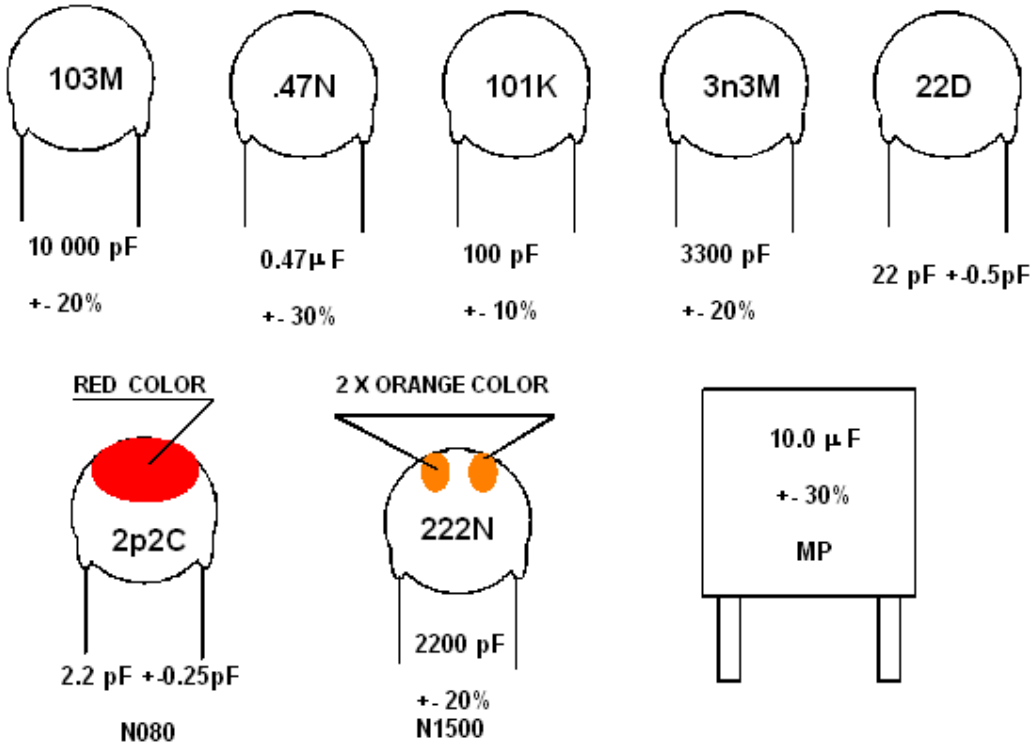

Figure 1

Inductor Color Code

Inductor color code

As usual an inductor is marked by four or five ring strips. Since you can find out the value of the inductor at any installation of this one on a printed-circuit-board. Read value of the inductor from the end with a narrow strip. Read a wide strip the last. **Table 1** shows the decoding of the color marks for inductors. Up to multiplier mark the value of the inductor is given in microHenry.

Four strip for mostly inductors used in the civil industry (**Figure 1**). However, military uses five ring strip, one wide strip (**Figure 2**) just tells you that it is a military inductor. May be you never meet with a military inductor (I have seen only a few military inductors…), but you should know about this one.

You can easy distinguish an inductor from a resistor. The inductor is more thick the resistor and sometimes shorter. Anyway you can use a DMV (Digital Multi Voltmeter) to prove that the part has resistance close to 1 Ohm (the resistance of shortened wires probe), so, you make sure this one is an inductor.

Table 1 Inductor color code

Mark color	1 mark	2 mark	Multiplier	Tolerance, %
silver	-	-	10^{-2}	+-10
gold	-	-	10^{-1}	+- 5
black	-	-	1	+- 20
brown	1	1	10	+- 1
red	2	2	10^{2}	+- 2
orange	3	3	10^{3}	+- 3
yellow	4	4	10^{4}	+- 4
green	5	5	-	-
blue	6	6	-	-
violet	7	7	-	-
grey	8	8	-	-
white	9	9	-	-
none	-	-	-	20

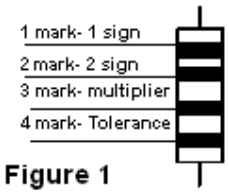

Figure 1

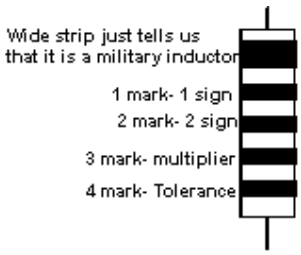

Figure 2

ANTENTOP

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