

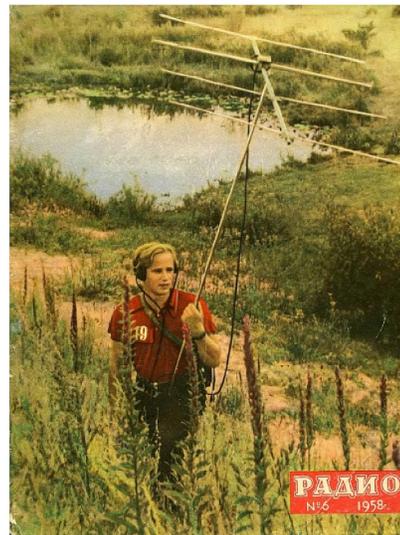
Ground Plane Antenna for 40-, 20-, 15- and 10- meter Bands

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Originally the antenna was used (and described) by polish ham Kahlickiy in 1946 year. The advantage of the antenna is that only one relay is used to switch the four working bands of the antenna. Vertical radiator of the antenna is grounded so the antenna may be used near lightning storm period.

To understand how the antenna is matched and tuned we need to review some pieces of the antenna theory. Let's see to the **Figure 1** and **Figure 2**. **Figure 1** shows "active antenna input resistance" vs "ratio antenna length/working wavelength". **Figure 2** shows "reactance of antenna input impedance" vs "ratio antenna length/working wavelength". The diagrams are simulated for vertical radiator placed above ideal ground. However, 4- counterpoises with length equal to the vertical part of the antenna are satisfactory analogue of an ideal ground.



Radio # 6, 1958

Based on the **Figure 1** and **Figure 2** it is possible to find antenna impedance of the vertical radiator Vs of the length of the vertical. When the physical length of the vertical radiator is the value that is multiplied by the 0.25 lambda, the input impedance of the radiator is only resistive. Radiator has inductance reactance in the input impedance at the physical length from 0.25 to 0.5- lambda. Radiator has capacitance reactance in the input impedance at the physical length from 0.5 to 0.75- lambda. And so on.



Header of the Article

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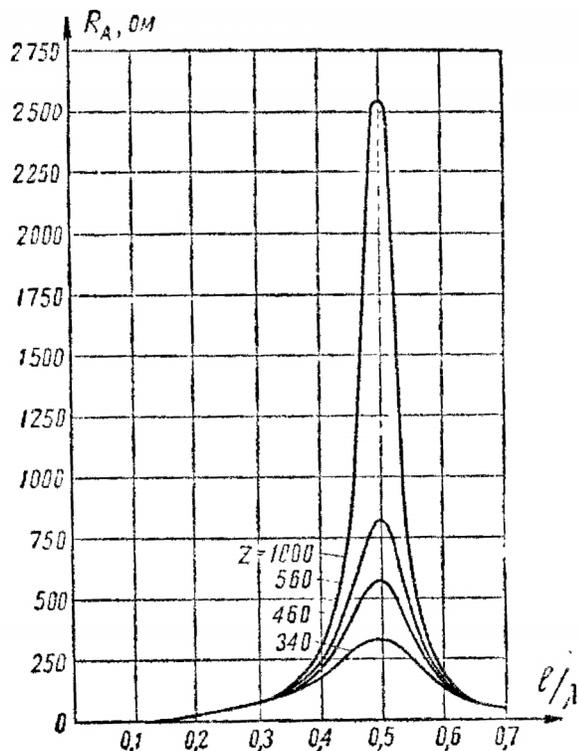


Figure 1 "Active Antenna Input Resistance" Vs "Ratio Antenna Length/Working Wavelength"

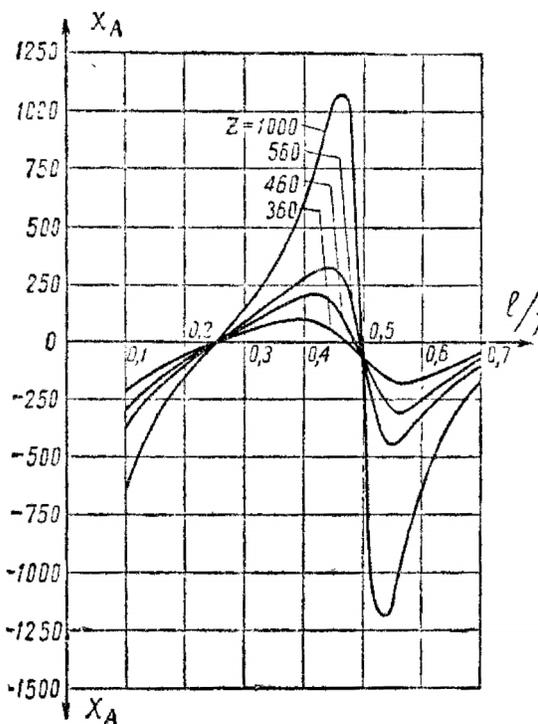


Figure 2 "Reactance of Antenna Input Impedance" Vs "Ratio Antenna Length/Working Wavelength"

However, for to any antenna to radiate efficiently this one should be matched with the feeder. As usual it is not complicated to match an antenna in narrow frequency band. Antenna is matched with the feeder with help of a circuit that commonly consist of from capacitors and inductors.

The circuit that is called Antenna Tuning Unit does compensation of the antenna reactance and transforms antenna resistance to the feeder. However it is very hard to find such ATU that would be worked at several bands without changing parameters of its parts. But it was found off for the antenna! **Figure 3** shows the ATU.

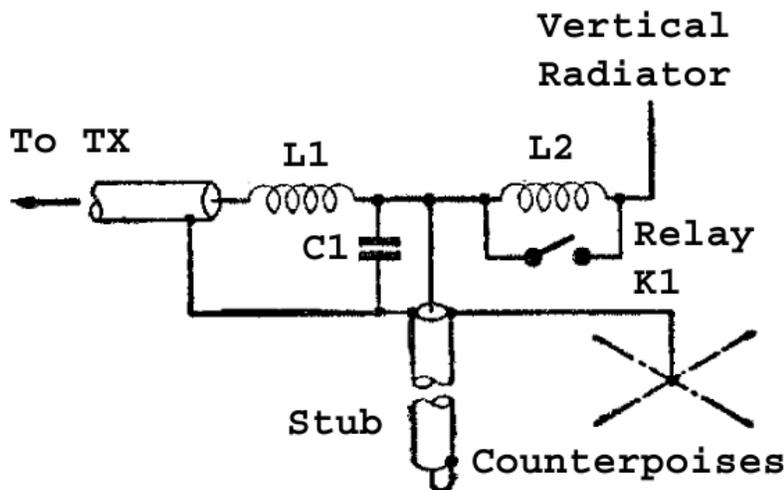


Figure 3 ATU of the Ground Plane Antenna for 40, 20, 15 and 10- meter Bands

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The ATU has a closed stub made of a coaxial cable with electrical length 1.25λ for the 15- meter Band. At the band the stub has high resistance impedance and antenna is tuned with help L1 and C1. At the 20- meter band the stub has capacitance impedance what is needed to match the antenna at the band. At 10- meter band the stub has inductance impedance what is needed to match the antenna at the band.

Item 1: Porcelain Base Insulator

Item 2: Span- Counterpoise

Item 3: Lengthening Inductor L2

Item 4: Radiator Base

Item 5: Radiator

Item 6: Antenna Support Base Tube

Item 7: Feeder and Closed Stub

Four counterpoises were used with the antenna. Each counterpoise had length 530- cm, diameter 2- mm and was installed at 45- degree to the Antenna Support Base Tube. Metal roof may be used instead of the counterpoises in case if the antenna is installed above such roof. Vertical radiator made of from an aluminum tube in diameter 4- cm and has length 530- cm.

Original ATU was calculated to match the antenna with coaxial cable 88- Ohm. **Table 1** gives data for the ATU for coaxial cables 88-, 50- and 75- Ohm.

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At the 40- meters band a lengthening inductor L2 is used to match the antenna. The inductor is closed with help of Relay K1 at the other bands.

Good match of the antenna is possible only on one band- 15- meter. At the other bands the match is only satisfactory. **Figure 4** shows design of the antenna base with ATU. ATU should be placed into weather-proofed plastic or metal box.

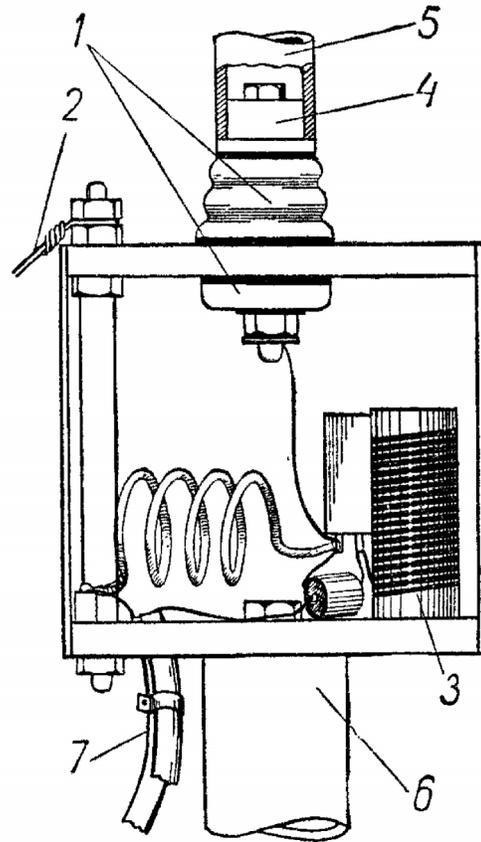


Figure 4 Design of the antenna base with ATU

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Table 1 Data for the ATU for Coaxial Cables 88-, 50- and 75- Ohm

		Coaxial 88- Ohm	Coaxial 75- Ohm	Coaxial 50- Ohm
L1, micro- Henry		0.825	0.8	0.7
L2, micro- Henry		6.6	7.0	6.3
C1, pF		64	68	83
Length of the closed Stub, meter		10.7	11.4	11.4
SWR	10-meter	1.1	1.12	4.0
	15- meter	1.0	1.0	1.0
	20- meter	2.2	2.22	1.7
	40- meter	3.6	2.8	1.05



Photo from WW II. Belorussian partisans listen to Radio Moscow