Old computer's PSU gives useful parts for antennas

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A personal computer has become an ordinary thing in the recent time. Nearly every radio amateur has his own personal computer. With the course of time some computer's blocks fail and are replaced by new ones. Soon the old computer is replaced by a new one. Finally, a radio amateur accumulates faulty computers as well as faulty and unnecessary computer's pieces.

But do not throw away the faulty pieces! It is possible to find useful applications for them in a ham practice. This article is a chat about the practical usage of an output transformer from a faulty old Power Supply Unit (PSU).

Photo: Old PSU

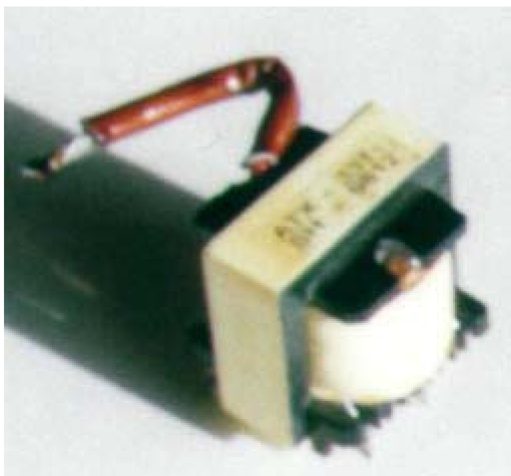
Photo: Opened PSU

An output transformer is the most useful part of a PSU

I believe an output transformer is the most useful part of a PSU and this detail can find its useful application in antennas. An output transformer has a large ferrite core and works on high frequencies (60- 200 kHz). In addition an output transformer has a qualitative electrical isolation between its primary and secondary windings. The isolation withstands 300 volts across the windings.

It is to be mentioned that there is a good deal of different models of computers' PSUs. However a PSU's output transformer has practically identical data for all PSUs having the same power. I had a faulty ATX PSU. **Fig. 1** (see next page) illustrates the circuit of the ATX PSU. The output transformer from the ATX PSU had a mark "ATX-33T". The transformer was soldered out accurately, and I started to experiment with it.

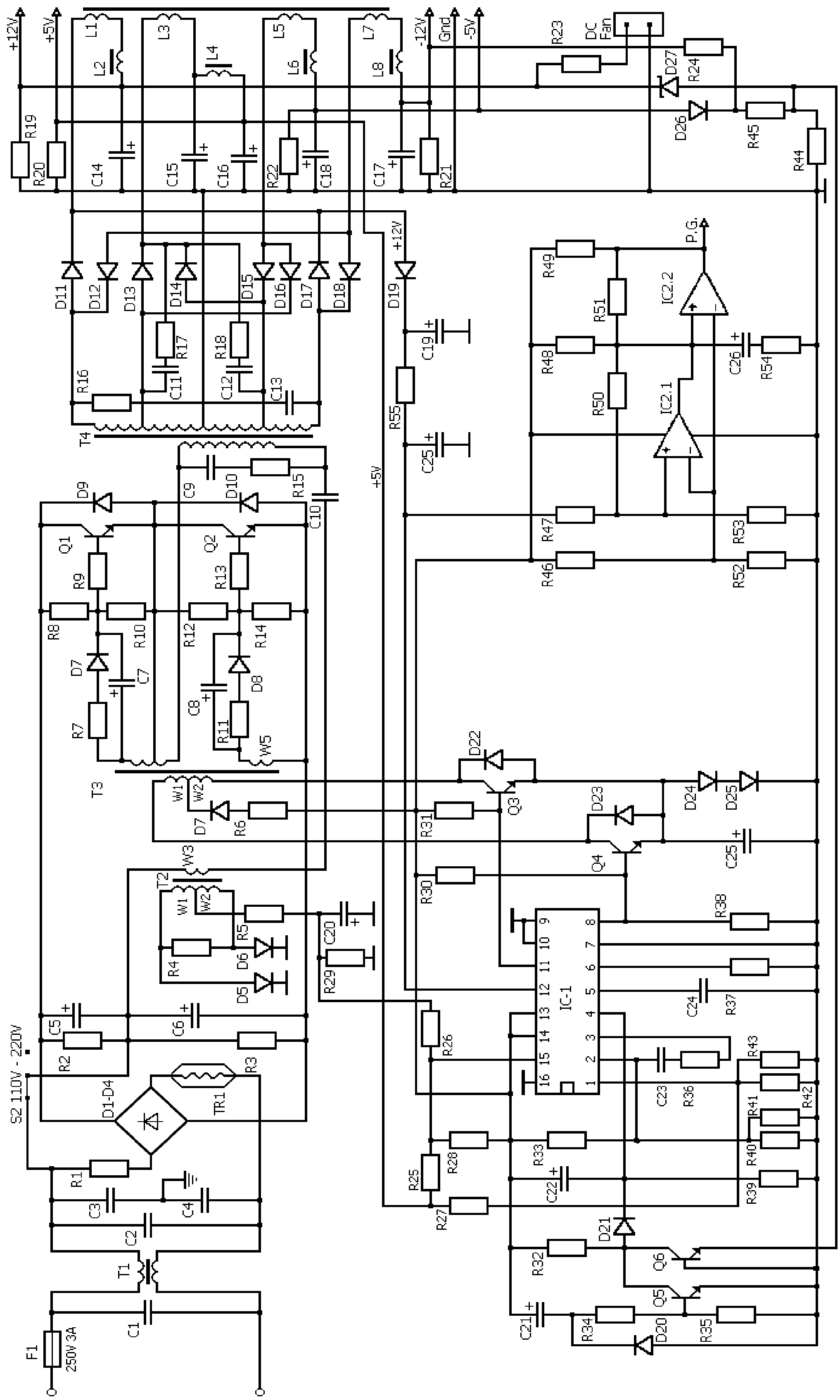
ATX- 33T transformer



ATX- 33T transformer as an RF transformer

Fig. 2 shows ATX-33T transformer's circuit cut out from the circuit of the ATX PSU. ATX-33T transformer has the primary winding connected to output transistors of a DC/DC converter, and the secondary tapped winding providing several low voltages necessary to feed a computer. The secondary winding has fewer turns than the primary one. I supposed the ATX-33T transformer could transform a low RF voltage to high with low losses. In this case the ATX-33T transformer could be used to transform the coaxial cable low impedance (50 Ohms) to a high impedance 300 (450, 600) Ohms. In this case an ATX-33T transformer could be installed at feeding terminal of high – resistance antennas, for example, at a Beverage or T2FD antenna.

Figure 1 ATX PSU



Experiments, experiments

I made a considerable amount of experiments with my ATX-33T transformer. I investigated its input impedance on all amateur HF ranges and I worked out its efficiency on the ranges. **Part II will contain the description how I researched the ATX-33T transformer.** ***Note:*** Any RF transformer should have a good ***efficiency***. Efficiency (Eff) is the ratio of useful power dissipated at transformer's load to input power incoming to the RF transformer.

I scrutinized all the data received due to my experiments and found only three usable while the ATX-33T transformer worked well as a RF transformer. All of the three usable connections are described below.

ATX- 33T transformer

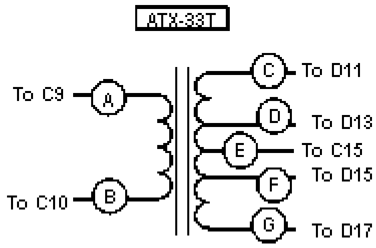


Figure 2

An optimum RF transformer

Let's begin with the best connection. AT- 33T transformer works quite well as an RF transformer while its low- voltage winding with summary voltage of 17 volts serves as an input winding. **Fig. 3** shows the connection. Mind, there are two almost equal connections, bottom (points **D- G**, **Fig. 3A),** and top (points **C- F, Fig. 3B)**. The connections differ from each other very little in their parameters. Use that connection (experimentally find it) where the RF transformer has the maximum efficiency.

Data for the RF transformer are shown in **Tab. 1- 3**. **Tab. 1** shows data for the RF transformer while this one is loaded to 300 Ohms. **Tab. 2** shows data for the RF transformer while this one is loaded to 450 Ohms. **Tab. 3** shows data for the RF transformer while this one is loaded to 600 Ohms.

An optimum transformer

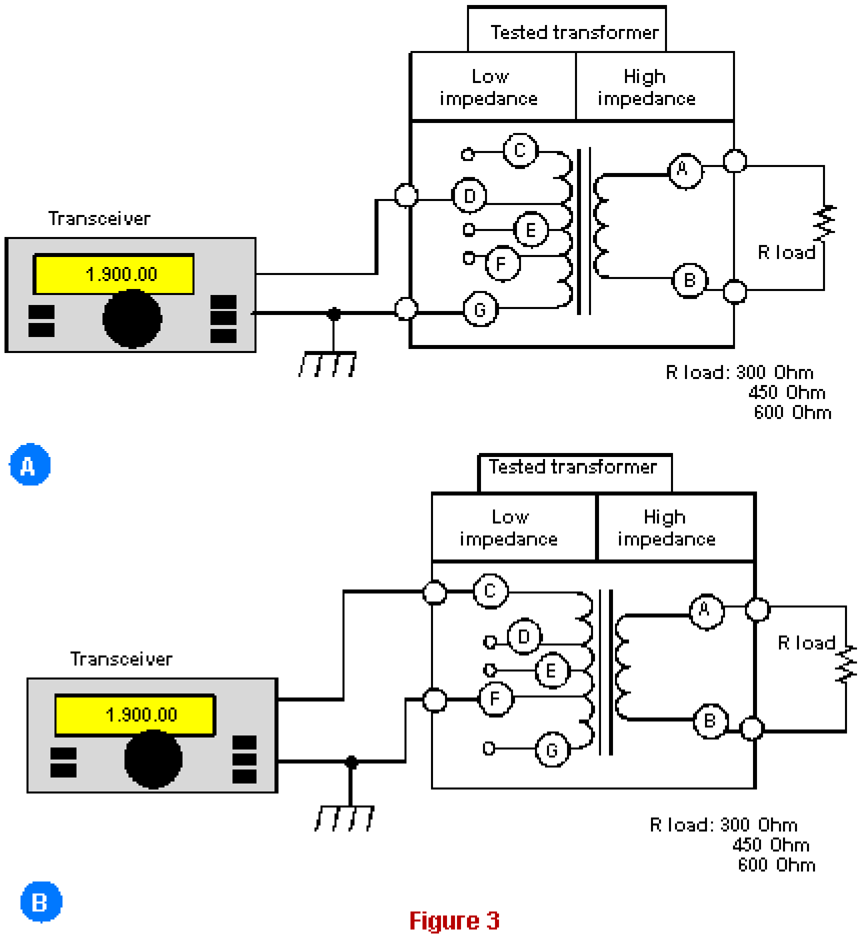


Figure 3

Table 1 An optimum transformer loaded to 300 Ohms

Frequency, MHz	1.9	3.7	7.1	10.1	14.2
Input resistance, Ohms	35	27	42	40	30
VSWR relative to 50 Ohms	1:1.49	1:1.93	1:1.24	1:1.16	1:1.31
Efficiency, %	85	98	60	20	12

Table 2 An optimum transformer loaded to 450 Ohms

Frequency, MHz	1.9	3.7	7.1	10.1	14.2
Input resistance, Ohms	38	35	45	40	40
VSWR relative to 50 Ohms	1:1.37	1:1.49	1:1.16	1:1.31	1:1.31
Efficiency, %	93	98	40	20	12

Table 3 An optimum transformer loaded to 600 Ohms

Frequency, MHz	1.9	3.7	7.0	10.1	14.2
Input resistance, Ohms	45	46	38	40	38
VSWR relative to 50 Ohms	1:1.16	1:1.14	1:1.37	1:1.31	1:1.37
Efficiency, %	96	98	35	18	12

Note: The data given in **Tab. 1- 3** were taken while the secondary winding (points **A** – **B**) was not grounded. The grounding slightly changes the data. If the grounding is necessary, use that connection to the ground (find it experimentally) where the RF transformer has the maximum efficiency.

Using data from **tab. 1-3**, I made diagrams for three transformer's loads – 300, 450 and 600 Ohms. The diagrams show:

- An input resistance vs. frequency (**Fig. 4**),
- A VSWR relative to 50 Ohms vs. frequency (**Fig. 5**),
- The efficiency vs. frequency (**Fig. 6**).

Input resistance vs. frequency

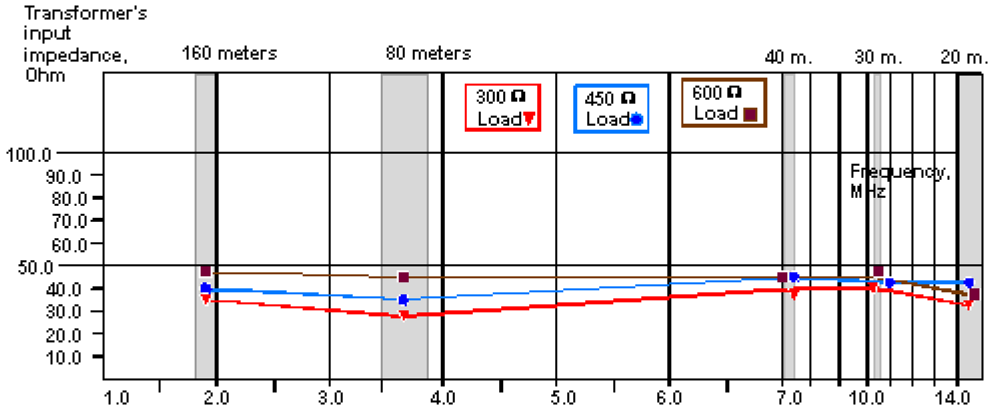


Figure 4

VSWR relative to 50 Ohms vs. frequency

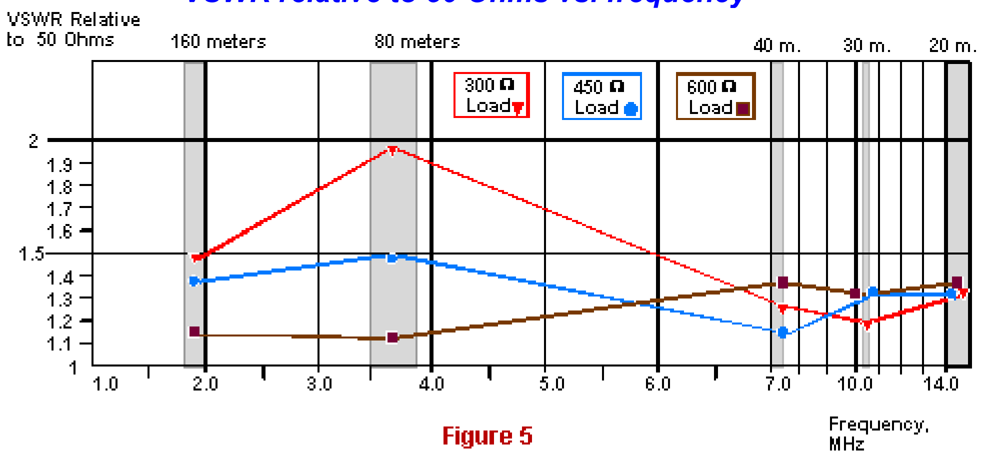


Figure 5

The efficiency vs. frequency

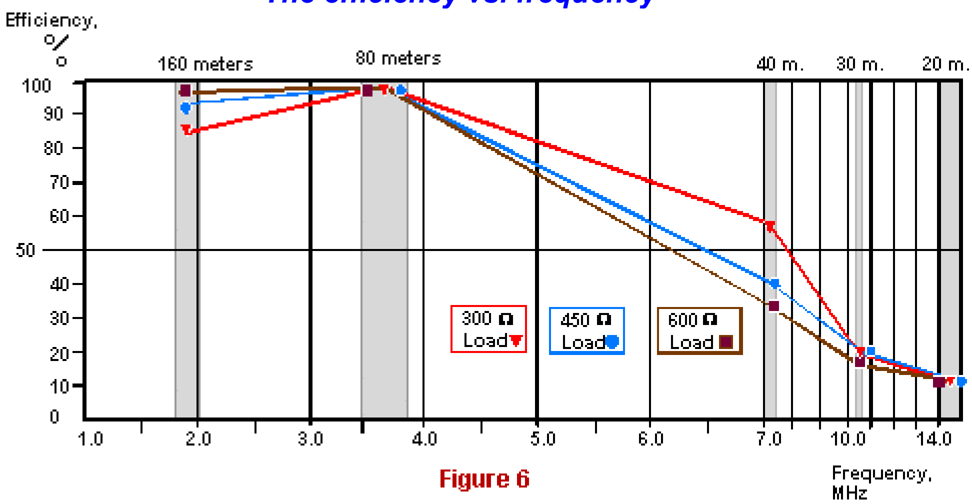


Figure 6

The most important parameter of any RF transformer is its efficiency. This RF transformer (**Fig. 3**) has a high efficiency only on ranges of 160 and 80 meters. The efficiency falls up to 60-35 percent (it depends on the transformer's load) on a range of 40 meters. It means that nearly half of the RF power going to the transformer heats its core but does not go to an antenna. Really, the transformer's core was very hot at my experiments with this transformer on 40 meters and upper. Other upper amateur HF ranges are dead for the RF transformer, and transformer works like a dummy load there. The RF transformer loaded to 300 Ohms has a VSWR almost 1:2 on a range of 80 meters. Such VSWR is not good for a work to transmit.

Conclusion for the connection shown in Fig. 3: The transformer can be used both in a transmission and reception mode on ranges of 160 and 80 meters with the transformer loaded to 450 or 600 Ohms. (An antenna Beverage or T2FD can be such a load.) The maximum of an RF power going to the transformer must be limited to 60 watts on the ranges. A 50-Ohm coaxial cable is to be preferred to use.

It is possible to use the transformer in a transmission and reception mode on a range of 40 meters while the transformer loaded to 300 Ohms, however the RF power going to the transformer should be limited to 10 watts.

An egg "Chupa - Chups"

Note: Do not use the transformer without a load! It causes a high VSWR and damage to the transformer. If the transformer is used outside it should be protected against atmospheric influences. It is possible to use an egg from a sweet – surprise "Chupa - Chups" for such a protection.

Transformer inside

Second variant of the connection for AT- 33T transformer

Second variant of the connection of a RF transformer

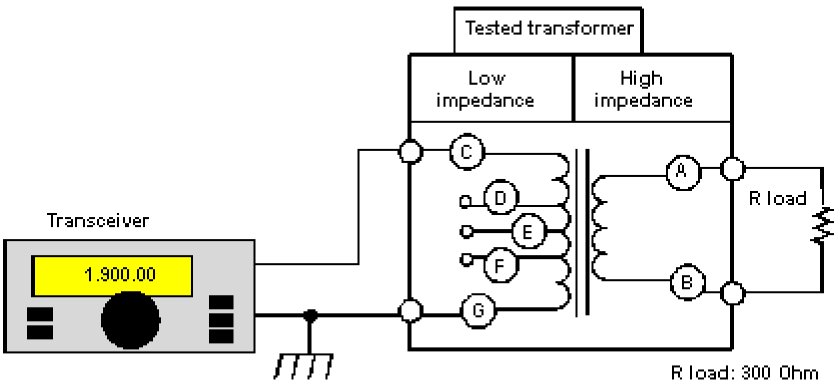


Figure 7

AT- 33T transformer works well as a RF transformer when its low- voltage winding with summary voltage of 24 volts serves as an input winding. Fig. 7 shows the connection.

Data for the RF transformer are shown in **Tab. 4- 6**.

Tab. 4 shows data for the RF transformer while this one is loaded to 300 Ohms. **Tab. 5** shows data for the RF transformer while this one is loaded to 450 Ohms. **Tab. 6** shows data for the RF transformer while this one is loaded to 600 Ohms.

Table 4 RF- transformer loaded to 300 Ohms

Frequency, MHz	1.9	3.7	7.1	10.1	14.2
Input resistance, Ohms	50	60	65	65	50
VSWR relative to 50 Ohms	1:1	1:1.15	1:1.25	1:1.25	1:1
Efficiency, %	75	50	50	20	12

Table 5 RF- transformer loaded to 450 Ohms

Frequency, MHz	1.9	3.7	7.1	10.1	14.2
Input resistance, Ohms	60	65	60	60	50
VSWR relative to 50 Ohms	1:1.15	1:1.25	1:1.15	1:1.15	1:1
Efficiency, %	93	69	37	32	15

Table 6 RF- transformer loaded to 600 Ohms

Frequency, MHz	1.9	3.7	7.0	10.1	14.2
Input resistance, Ohms	75	70	64	50	45
VSWR relative to 50 Ohms	1:1.44	1:1.34	1:1.231	1:1	1:1.16
Efficiency, %	97	85	47	42	12

Note: The data given in **Tab. 4- 6** were taken while the secondary winding (points **A** – **B**) was not grounded. The grounding slightly changes the data. If the grounding is necessary, use that connection to the ground (find it experimentally) where the RF transformer has the maximum efficiency.

Using data from **Tab. 4- 6**, I made diagrams for three transformer's loads – 300, 450 and 600 Ohms. The diagrams show:

- An input resistance vs. frequency (**Fig. 8**),
- A VSWR relative to 50 Ohms vs. frequency (**Fig. 9**),

The efficiency vs. frequency (**Fig. 10**).

An input resistance vs. frequency

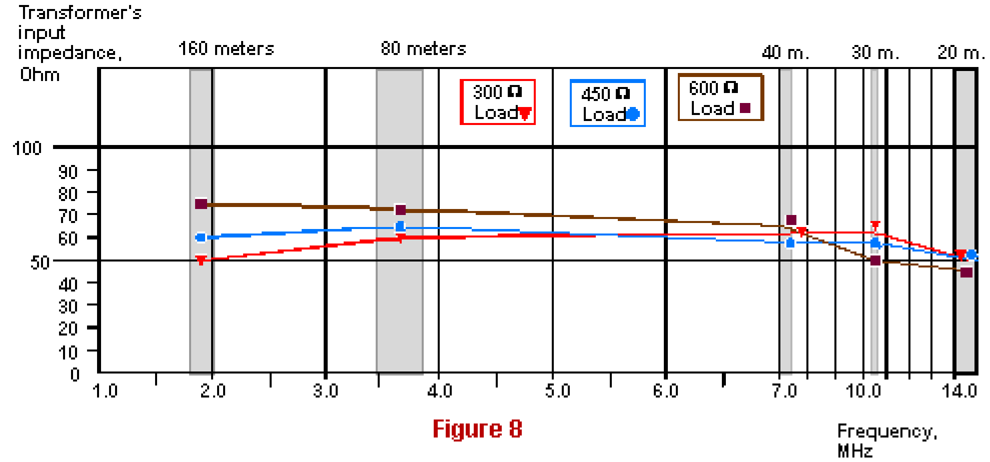


Figure 8

VSWR relative to 50 Ohms vs. frequency

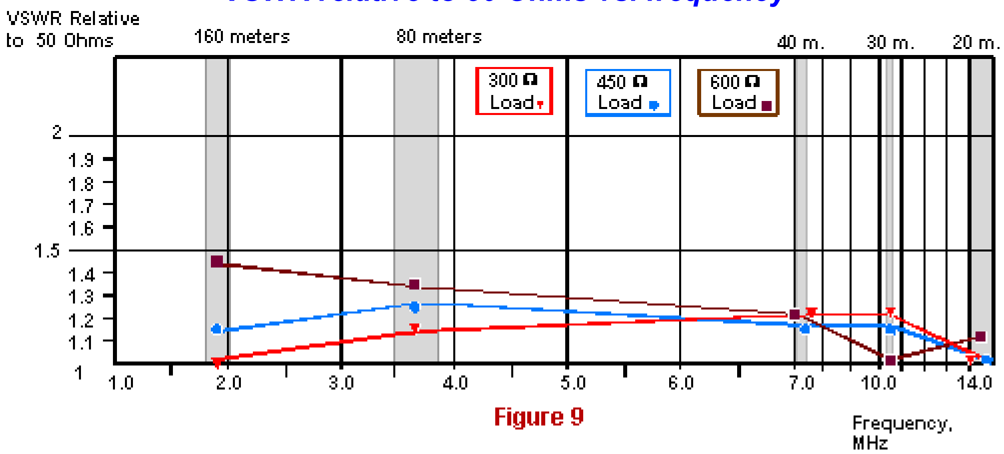


Figure 9

The efficiency vs. frequency

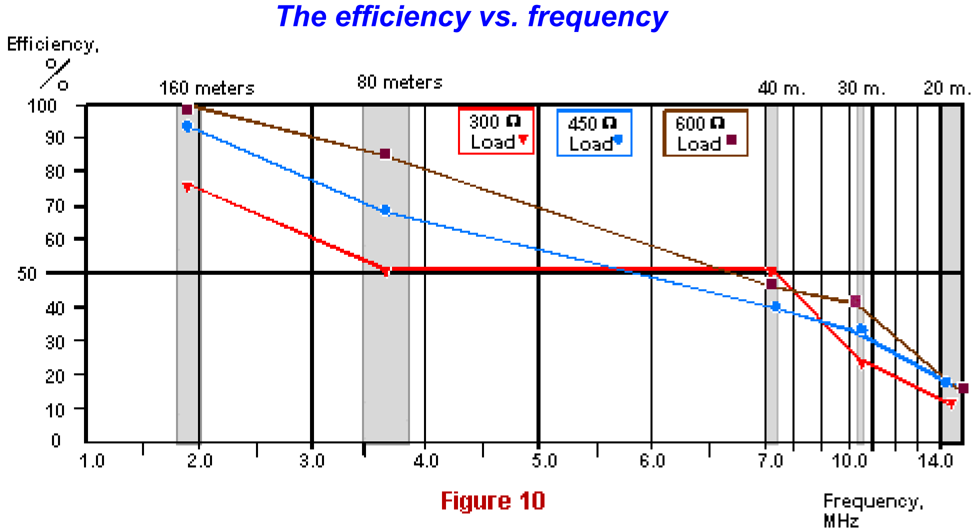


Figure 10

As it was mentioned above, the efficiency is the most important parameter of any RF transformer. The transformer has rather high efficiency and a small VSWR on a range of 160 meters while this one is loaded to 450 or 600 Ohms. As for a range of 80 meters the RF transformer shown in **Fig. 7** has less efficiency and higher input resistance compared to the RF transformer shown in **Fig. 3**. The efficiency falls down to 50-37 percent (it depends on the transformer's load) on a range of 40 meters. As for a range of 30 meters the efficiency is 42 percent while the transformer is loaded to 600 Ohms. It means that more than half of an RF power going to the transformer heats its core but does not go to an antenna. In fact, the transformer's core was very hot at my experiments with this transformer on ranges of 30 and 40 meters. A range of 20 meters is dead for the RF transformer.

Fig. 8 shows that the RF transformer **(Fig. 7)** has a high input resistance. So it is wise to use the transformer together with a 75-Ohm coaxial cable because a VSWR relative to 75 Ohms is less than a VSWR relative to 50 Ohms. **Tab. 7** shows a VSWR relative to 75 Ohms vs. frequency while the transformer is loaded to three different loads - 300, 450 or 600 Ohms. Using data from **Tab. 7**, I made diagrams for three transformer's loads. **Fig. 11** shows the curves.

Table 7 VSWR relative to 75 Ohms vs. frequency.

Frequency, MHz	1.9	3.7	7.1	10.1	14.2
VSWR relative to 75 Ohms to transformer's load 300 Ohms	1:1.5	1:1.25	1:1.16	1:1.16	1:1.5
VSWR relative to 75 Ohms to transformer's load 450 Ohms	1:1.25	1:1.16	1:1.25	1:1.25	1:1.5
VSWR relative to 75 Ohms to transformer's load 600 Ohms	1:1	1:1.08	1:1.18	1:1.5	1:1.67

A VSWR relative to 75 Ohms vs. frequency

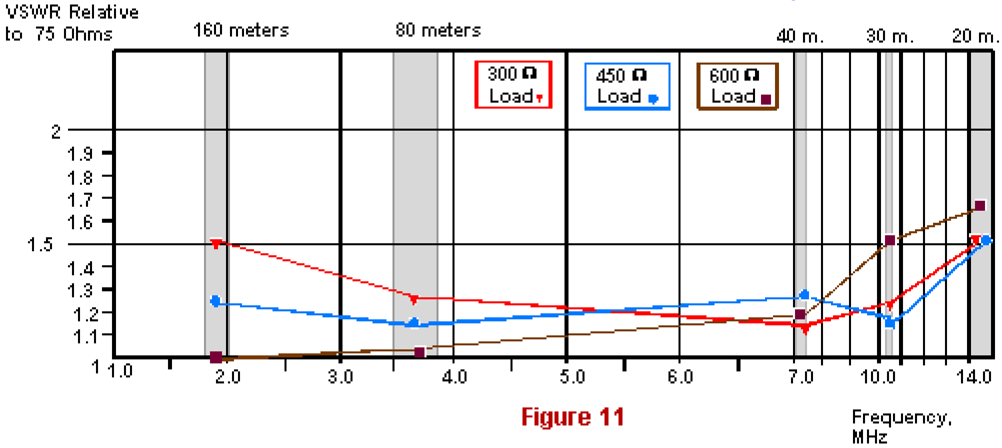


Figure 11

Conclusion for the connection shown in Fig. 7: The transformer can be used both in a transmission and reception mode on a range of 160 meters with the transformer loaded to 450 or 600 Ohms. (An antenna Beverage or T2FD can be such a load.) A 75-Ohm coaxial cable is to be preferred to use while the transformer loaded to 600 Ohms and a 50-Ohm coaxial cable is to be preferred to use with the transformer loaded to 450 Ohms. The maximum of a RF power going to the transformer must be limited to60 watts on a range of 160 meters. The transformer can be used in a transmission and reception mode on a range of 80 meters with the transformer loaded to 450 or 600 Ohms. The maximum of the RF power going to the transformer must be limited to 30 watts on a range of 80 meters. On ranges of 160 -80 meters it is possible to use the transformer only for a reception mode with the transformer loaded to 450 or 600 Ohms and its primary winding is connected to a 75-Ohm coaxial cable.

To be continued….