All pictures © hb9aik - vk2ani

EKB Shortwave Receiver

made in GDR by VEB Funktechnik Dabendorf

Restauration of the Czech Model R5 with AC P.S.

Description & Picture Gallery

Preface: The Small Print

When using the information on these pages for your work please note the following terms and conditions. By using any of the information presented you accept these terms. Thank you!

Restoration Projects Philosophy

The purpose of many restoration projects described here is to bring the antique equipment back into working condition close to original specifications while generally preserving their historic electronic and mechanical design. This means that often new components (e.g. capacitors) need to be used - in many cases NOS will not do - which sometimes require small mechanical modifications to the set.

This treatment does not conform to "museum" standards that require everything to be left or restored to original. This is an entirely different approach. It is up to you to decide what you want to do.

Modifications and Homebrew Projects

The projects shown are for information only with the main goal to motivate fellow amateurs and hobbyists to start on similar projects. Comments for improvements are always welcome. They are always "prototypes" and not a kit. You'll have to find your own parts. No warranty is given nor implied that they actually work in your situation.

And please note that a modified piece of equipment looses its collector value - but brings joy to its successful operator!

Copyright

Regulations

Many of the described obsolete radios (or computers) no longer fulfill today's requirements for e.g. electrical safety, EMC, used bandwidth, levels of harmonics or spurs or intermodulation. While at times suitable corrective action is included in my descriptions, many times it is not. It is your responsibilty to make sure your equipment conforms to the requirements in your own country.

Safety while Working on the Projects

*It is your own responsibility and all-important to always observe proper safety procedures in your work. Some of these projects - certainly almost all vacuum-tube circuits - involve high voltages, some lethal indeed. Make sure you understand what you are doing or else get some qualified help here. Just look at **this page** to see some tips on this one.*

Always "Switch to Safety" when you work on your equipment! Please pay attention to proper grounding of all metal chassis and enclosures and consider the use of GFCI breakers to your shack/workbench.

This information and much more can be found on my website https://hb9aik.ch

1. Introduction

This receiver covers the HF frequencies from 1.5 to 22MHz in 6 bands and was designed for A1, A2 and A3 transmissions. SSB reception is however possible.

It was used in the East German Armed Forces (NVA) from 1962 to 1968 and was the first generation of sets using semiconductors[1].

2. Circuit Description (short version)[2]

The EKB / R5 is a single conversion (A3, A2) or double conversion (A1, calibrate) receiver.

The antenna input is well protected by a series lamp (fuse) and a glow lamp to prevent damage e.g. when operated close to transmitters. An RF amplifier DF669 is followed by the DF97 mixer tube (which is – in contrast to all other subminiature tubes used – a 7pin minature unit). It appears that this has been selected due to the separate pin for the suppressor grid allowing a better isolation of the mixer output from the LO which uses a DF668. The 1st IF is 900kHz and is amplified in three stages DF669 before fed to the demodulator/AVC diodes for A3 and A2. Selectivity is 4.5 ±0.5kHz.

For better selectivity (1 ±0.2 kHz) when using A1 the IF signal is converted to the 2nd IF 32kHz by a 932kHz crystal oscillator DF669 which also serves as calibration (▼) source .

All amplification of the 2nd IF and audio signals is performed by germanium transistors OC811 and diodes OA645. A tone filter of ~1000Hz and ~200Hz b/w helps to improve CW transmissions in A2T or A1T.

The battery used provides 1.2V @ 0.4A (heaters) and 7.2V @ 0.15A for the transistors and the internal DC-DC converter (2x OC821, 2x OY102) which provides the plate voltage of 60V. An optional external power supply – as described later in its Czech implementation ZS-R5 – needs to provide the same two voltages.

3. My Czech R5 Receiver

Some time ago I was able to get two Czech R5 receivers which had a Czech made AC power supply ZS-R5, a mobile mount and an accessory pocket in camo-design.

The front panel text is Czech, but the insides are still marked in German – e.g. „Rö“ for tubes - and the sets were visibly EKBs made in the GDR for export to partner services. One receiver has the miniature meter while the other has not. The units are painted military green.

The accessories consist of a vertical antenna and support (Kulikow, not the GDR spring version), wire antenna, headphones and a small operators booklet in Czech (1962) covering the receiver and a small booklet in Czech (1968) covering the power supply, the latter includes a circuit diagram.

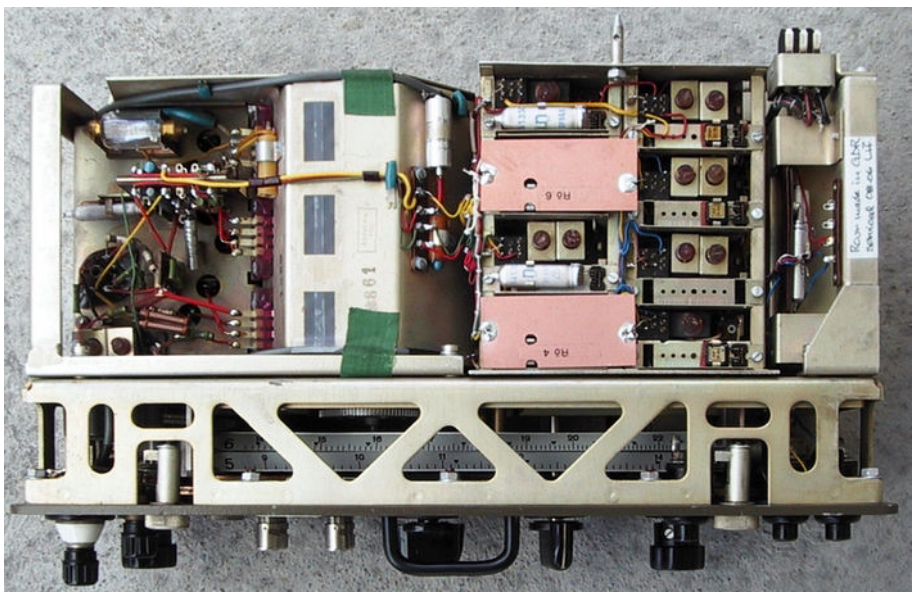
To work on the receiver itself, I had to obtain a copy of the official GDR document DV-44/35[3] which covers the EKB receiver and provides all the information needed.

1 This information is taken from „Nachrichtentechnik der Nationalen Volksarmee“ by Günter Fietsch DL9WSM, ©1993, ISBN 3-88180-318-1 (in German). An excellent overview of GDR radio sets.
2 All details are taken from DV-44/35 „Vorschrift zum Empfänger EKB“ published by the Ministry for National Defence (GDR) 1962. This corresponds ± to the US TM- documents and provides detailed descriptions, operating and field workshop maintenance instructions - including failure analysis (in German).
3 Document 123/27 from www.algra-funkarchiv.de in 2006.

The following pages show some pictures[4] of the (open) receiver. The careful and solid construction of this portable set is easily visible!

Front view of my R5 receiver

Bottom left to right: tune, 2x headphones 600Ω, scale calibration, mode switch and volume control. Top left antenna (low Z), ground. Top right scale light, battery voltage tests.

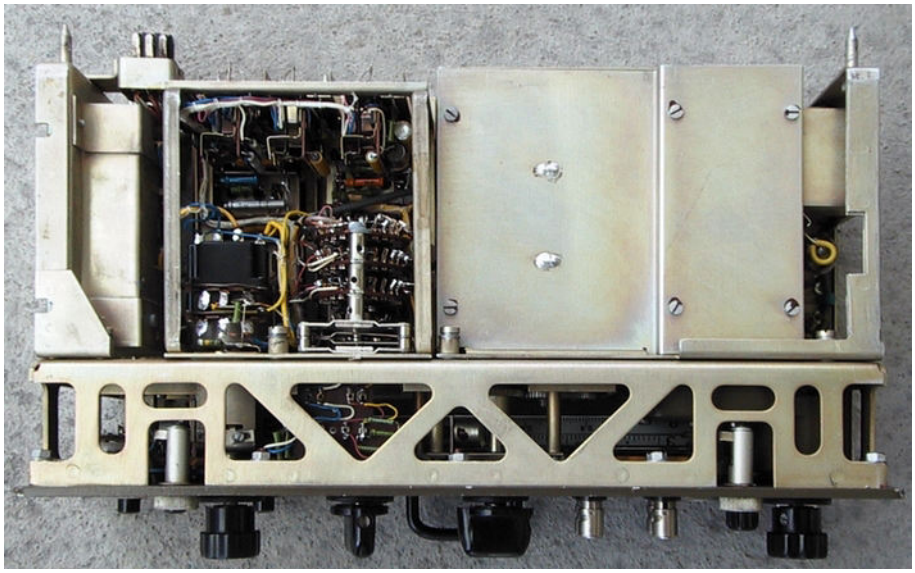


Top view, RF and Osc (DF668) on the left, 1st (DF669) and 2nd IF (OC811) on the right

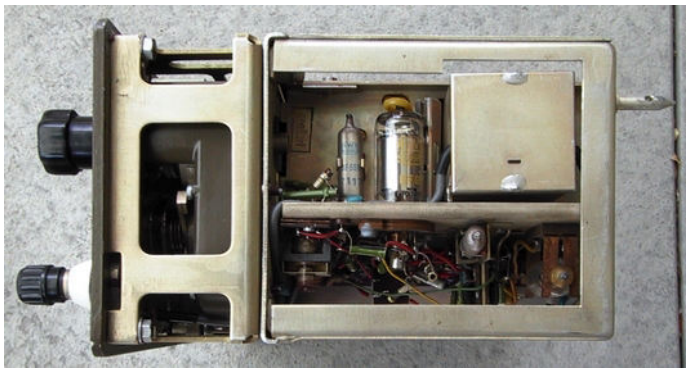
In this view the described shields (see below) in the 1st IF section can be seen. Covered by a metal screen is the RF coil turret that contains the coils for the covered 6 bands. In

4 Note that all digital pictures were taken with a technology over 10 years old… all © hb9aik 2007.

the 2nd IF section the flat OC811 germanium transistors (rectangular, black with white label) can be made out.



Bottom view, audio circuits and mode and power switches on the left



Side view, RF input (DF668) and mixer (DF97) section

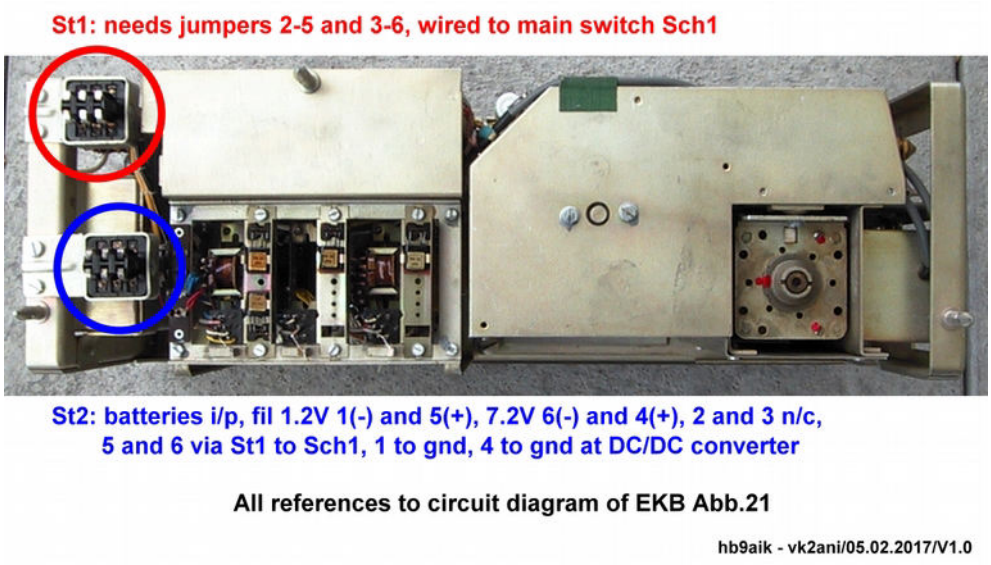
This shows the RF section, RF amp and mixer above and LO below. This connects to the contacts of the coil turret. Note the interesting combination of the miniature DF97[5] with the subminiature DF668.

The following picture shows the rear of the radio including the two power connectors. This information has been added due to some confusion in the numbering of these connectors. Unfortunately the numbering in the two circuit diagrams shown later is reversed: St1 connects to Zá2 and St2 connects to Zá1! Zá2 contains nothing but jumpers.

According to DV-44/35 an external power supply may be directly connected to St1 through a suitable cable, eliminating the need for jumpers and any batteries connected to St2 would then automatically be disconnected from the radio.

5 Tube equivalents: DF97=1AN5, DF668=1AD4, DF669=5678

In the picture below the flat OC811 germanium transistors[6] in their sockets can again be clearly seen.



Rear view, audio section left, tuning capacitor right, see also in text for St1 + St2

4. Receiver Circuit Diagram

The circuit diagram of the entire receiver is added at the end of this document. Note that the scan had to be made from a *copy* of DV-44/35 and is therefore of doubtful quality. However at least a full size PDF of this may be found separately on my website.

Should a better electronic copy of this be available it would be gladly included here.

5. Revision of my Receiver R5

The EKB[7] receiver is very nicely and solidly built and in my case came in excellent condition. Not much work at all was needed to bring it back to life – more however for the external power supply (see below). All tubes and transistors worked, it appeared that the receiver had not seen much use.

One problem encountered was an instable 1st IF amplifier, showing up as soon as the radio was inserted into its case (which appeared to increase coupling across the stages). First a wrong tube[8] was found (DF668 rather than a vari-μ DF669) but it still did not go completely away. Eventually two shields made from thin PCB material (to prevent shorts on the circuit side underneath) were installed over two IF stages (see picture of the topside) and this got definitely rid of all instability.

6 Transistor replacements: all were made by RFT in GDR and have a flat case which makes replacement a bit difficult. Perfomancewise any Ge PNP transistor should do such as the AF series in a TO18 case or US or Japanese equivalents. Beware of higher f_t (oscillations!) of some types.

7 EKB incidentally stands for „**E**mpfänger-**K**urzwelle-**B**atterie“ (receiver-shortwave-battery) and it has a brother called EUB, **U** standing for „**U**ltrakurzwelle“ (20-65MHz, VHF).

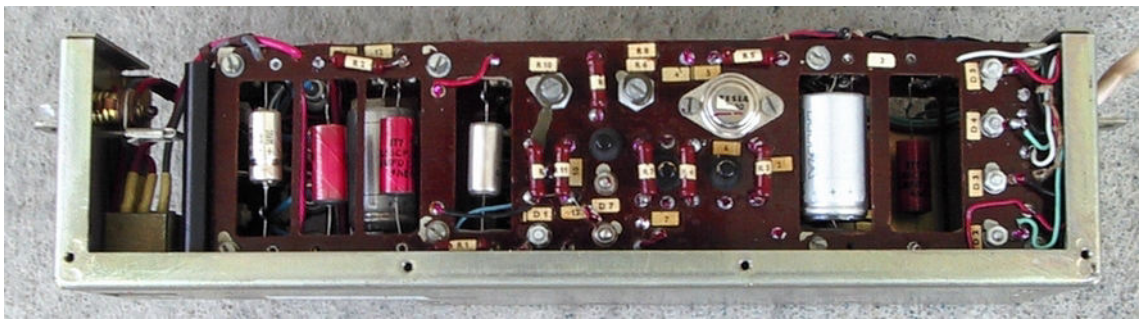
8 Recently it was found that other Czech receivers also had a DF668 in the IF amp‘s 3rd stage. Perhaps this was a field change as 3x DF669 are shown in the EKB diagram?

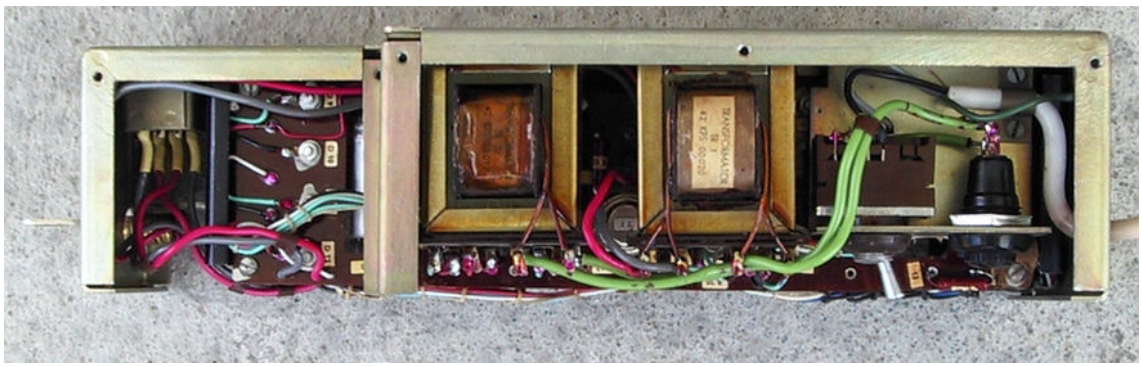
6. Revision of the Power Supply ZS-R5

Unfortunately the power supply was not built quite as well as the receiver and the electrolytics showed their age by visibly leaking.

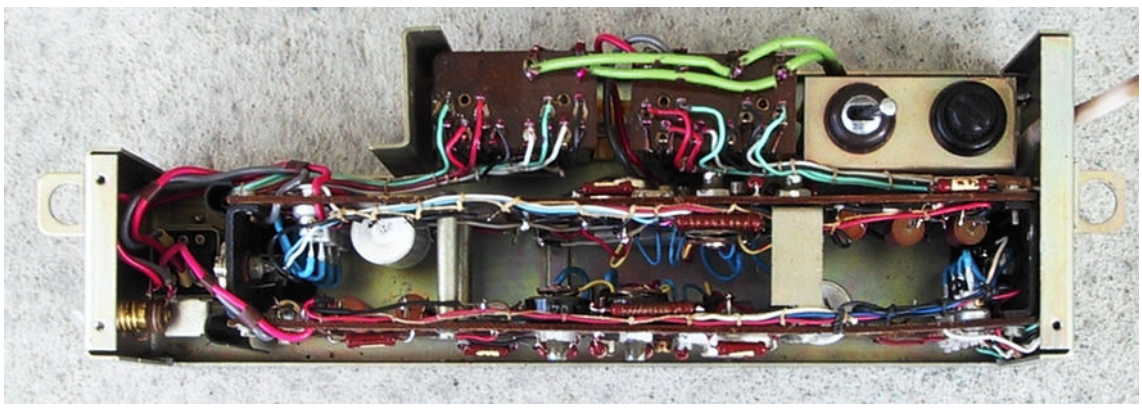
All capacitors and some rectifier diodes were replaced, but resistors, transistors and the wiring could be left in place. Nice old germanium technology!

The pictures below show the reconditioned power supply and the circuit diagram.





View from the top and bottom, note Zá1 on the left, new capacitors have been fitted



Front view i.e. towards the radio, note Zá1on the left with pins 2+3 n/c

In this view and the picture below the connectors to the radio can be seen. Only Zá1 is part of the active power circuitry while Zá2 is part of the chassis and not connected to the power supply circuitry. It contains two jumpers to complete the wiring in the radio.

The mains power switch and the mains fuse are located on the right hand side of the unit. They remain accessible in operation through a cutout in the battery box.

This shows the power supply in its metal case and installed in the battery box.

7. Building an external Power Supply

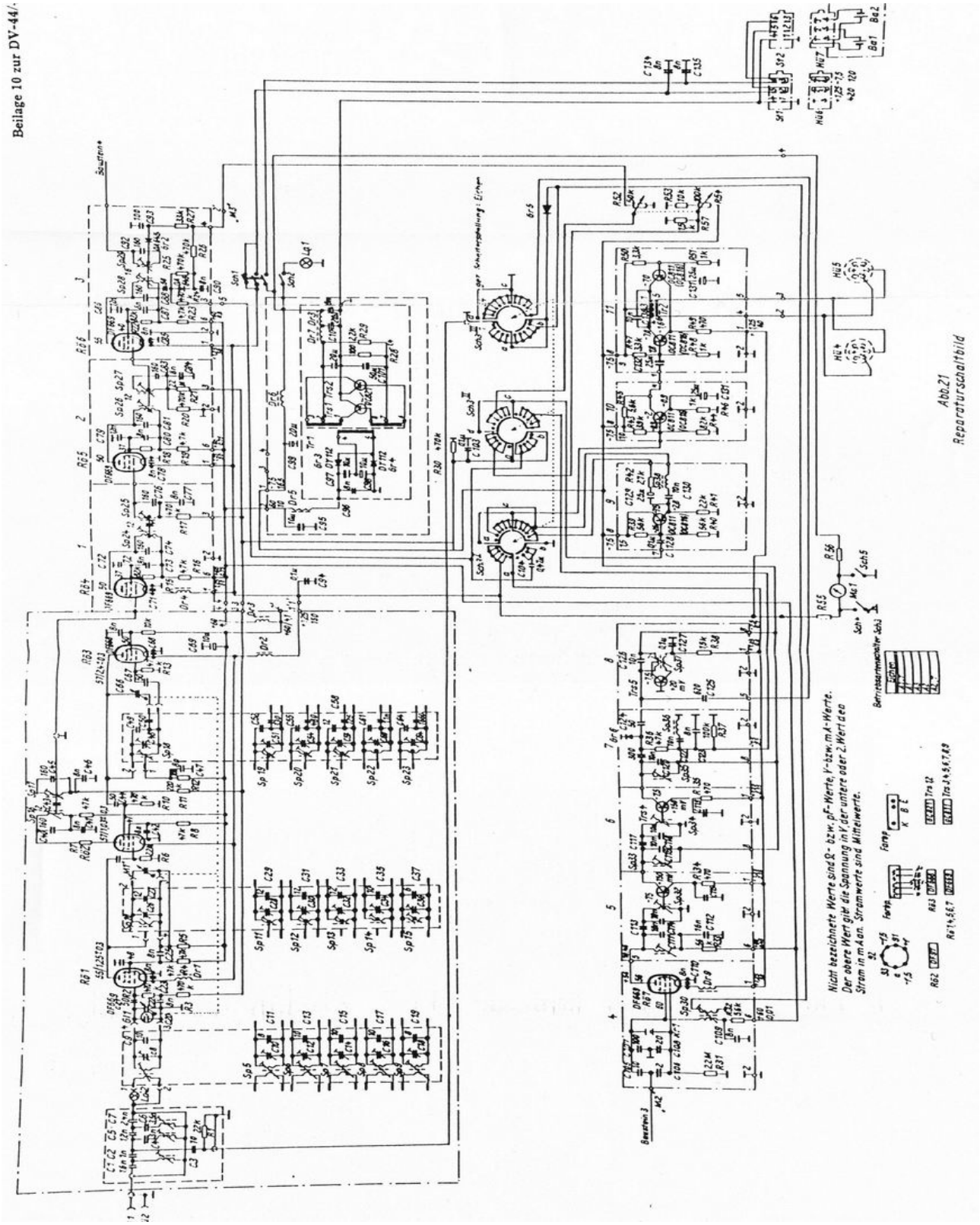
Two voltages are needed for the radio and it is important to note that – as DV-44/35 states - „two galvanically isolated batteries“ are needed i.e. there is no common connection in the supply and therefore a transformer with two separate windings needs to be used.

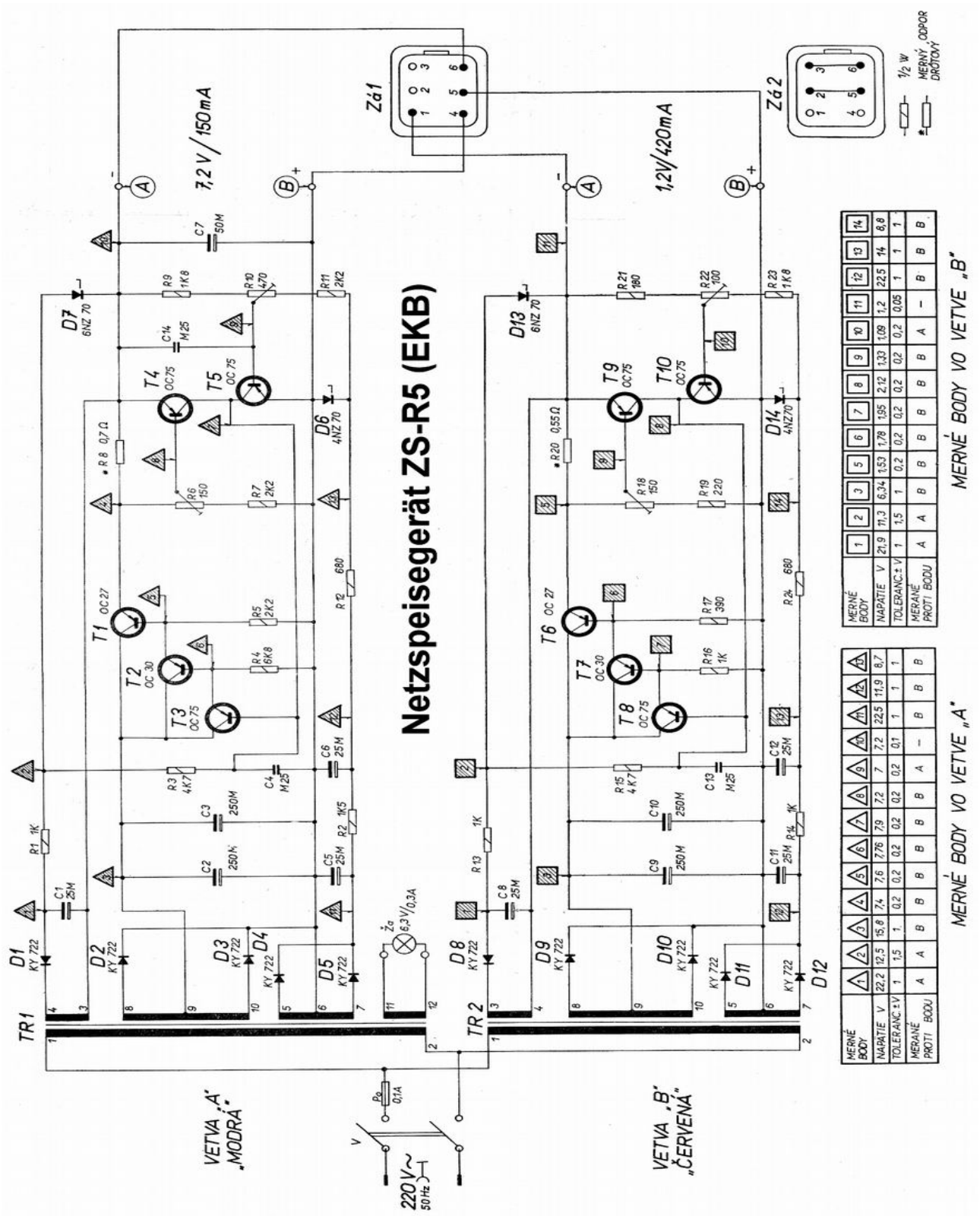
These days things can be made a lot simpler on the DC side and just a rectifier, capacitor an a regulator such as the LM317 can be used. The 500mA variant is sufficient also for the 1.2V filament supply, but this regulator will need a heat sink. The 7.2V supply needs an output capacitor of >47uF in view of the DC/DC converter in the radio. And remember to keep the regulators floating from each other and from the chassis.

No actual circuit is offered at this time as my radio has the ZS-R5, but will be included if someone builds one and wants to share it here.

8. Circuit Diagrams

The circuit diagrams for the EKB receiver and the ZS-R5 supply follow on the following pages.


Beilage 10 zur DV-44/-
Abb.21
Reparaturschaltbild


Netzspeisegerät ZS-R5 (EKB)
7,2 V / 150 mA
1,2V/420mA
Zá1
Zá2
TR1
TR2
VETVA „A"
„MODRÁ"
VETVA „B"
„ČERVENÁ"
220V~
50Hz
MERNÉ BODY VO VETVE „A"
MERNÉ BODY VO VETVE „B"
½ W
MERNÝ, ODPOR DRÔTOVÝ