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## ASSEMBLY MANUAL FOR R3500D DIRECTION FINDING RECEIVER KIT

Rev. A3

Updated 13 June 2022

Written by CRKITS

<http://www.crkits.com>

Thanks for your purchase from us. This model is the upgrade of PJ-80 – an 80-m ARDF direct conversion receiver kit. It keeps the characteristics of simple, low cost, easy to build, and suitable for the fox hunting and electronic homebrewing activities among youngsters, especially for the students of elementary and middle schools.

### Cautions

- The power supply is switched by the earphone plug. After use, please unplug the earphone to switch off the power supply.
- Monophonic earphone is not compatible with this receiver. Use the stereo earphone instead as attached.
- Pay close attention to differ the 3 diodes: VD1 (1N60), VD2 (FV1043) and VD3 (3V6). They look very similar, but the letters printed on the body of diode can easily tell.
- The English manual is for your reference only. Please refer to the attached Chinese manual for more information.
- **Note there is an error in the circuit diagram.** The center lead of the Ferrite (Magnetic) Rod Antenna is connected to GND as shown on the Component Placement Drawing and the PCB legend.

Rev. A3 – 13 June 2022 - Updates by Jan Verduyn SDR-Kits Ltd

## A. Main Specifications

1. Frequency coverage: no narrower than 3.5 - 3.6 MHz
2. Sensitivity: No less than 600 meters (when receives T3500B fox transmitter with vertical antenna)
3. Directivity: The minimum distance for exhibiting directivity is less than 3 meter
4. Power supply: DC 6V (4x AA size batteries)

## B. Circuit Diagrams

### 1. Block Diagram

See the printed manual.

(Boxes from left to right: Antenna, RF amplifier V1, Beating frequency detector VD1, AF pre-amp V2, AF power amplifier TDA2822M, earphone. The lower box: Variable beating frequency oscillatorV3)

### 2. Schematic and PCB layout

See the printed manual in Chinese Language. **Note there is an error in the circuit diagram.** The Center lead of the Ferrite (Magnetic) Rod Antenna is connected to GND as correctly shown on the Component Placement Drawing and the PCB legend

## C. Assembly Instruction

### 1. Check and solder parts on PCB

Before soldering, carefully make parts inventory based on the part list to check the quantity, value and quality of all components. For example, check if the electrolytic capacitor is dried or leaking, or the coils T1 (black cap) and T2 (white cap) are open, or the diodes and transistors are OK. Pay attention to the right orientation when installing TDA2822M and its socket (see Fig. 2 on the printed manual).

### 2. Install and fix the magnetic rod

Connect Magnetic Rod Coil as shown on the PCB legend.

Use the white nylon ribbon to fix the magnetic rod onto the PCB.

### 3. Install the vertical antenna

Insert the telescope antenna from the hole on the top right of the case, and fasten it with screw and nut. A washer shall be put between the screw and the outside of the plastic case.

### 4. Cautions for installing the battery wires

Only install battery wires after all the components are soldered and checked okay. Make sure the polarities are correct.

## D. Alignment

### 1. DC check point

(1) Voltage across the zener diode VD3: 3.4 - 4.4 volt

(2) The bias of transistor V1: The voltage across R4 shall be 0.4 - 1 volt (potentiometer RP1 set to maximum gain position, the  $I_c$  of V1 will be 0.4 - 1 mA)

The bias of transistor V2: The voltage across R10 shall be 1.5 - 3 volt (the  $I_c$  of V2 will be 1.5 - 3 mA)

The bias of V3: The voltage across R15 shall be 2 - 2.5 volt ( $I_c$  of V3 will be 2 - 2.5 mA)

Normally you don't have to adjust the bias, because the design can cover the variance of the components.

### 2. Alignment of the variable local oscillator

(1) If you have a standard RF signal generator

(a) Set potentiometer to the center position;

(b) Set signal generator to 3.5 - 3.6 MHz, CW mode, higher output level. Connect the output and the ground of the signal generator with a wire. Couple the wire to the magnetic antenna of the receiver by winding the wire on one end of the magnetic rod for one turn;

(c) Change the output frequency of the signal generator in a wider range. A beating tone shall be heard from the earphone, this means the local oscillator is working. Set the signal generator to 3.55 MHz, then align the cap of the coil T2 (white) until the beating tone is heard again;

(d) Turn potentiometer RP2, the signal of 3.5 MHz and 3.6 MHz all be received at two position of RP2, which shall be near by the both extreme positions. If 3.6 MHz can not be heard but the 3.5 MHz can be heard at the RP2 position near by the center, please align the cap of T2 counter clock wise; or vice versa.

(e) If the receiving coverage is too wide, replace the R13 with greater value, or vice versa.

(2) If you use 80m fox transmitter

(a) Set potentiometer RP2 to the center position;

(b) Turn on the fox transmitter (3.55 or 3.54 MHz). Place the receiver close to the transmitter antenna;

(c) Turn the cap of T2 until a beating tone is heard, fine tune it to make the tone nicely (about 1000Hz);

(d) Turn the potentiometer RP2, the signal from fox transmitters of 3.5 and 3.6 MHz shall be both heard. If only one signal of 3.5 or 3.6 MHz can be received, please fine tune the cap of T2 (see the previous section);

(e) If the receiving coverage is too wide, replace R13 with a greater value, or vice versa.

### 3. Alignment of antenna tank

Receive a signal of 3.53 MHz from a signal generator or transmitter. Fine tune capacitor CT to peak the tone. If no peak can be obtained, change the position of the coil on the magnetic rod, then fine tune CT again.

#### 4. Alignment of the tank in the RF amplifier

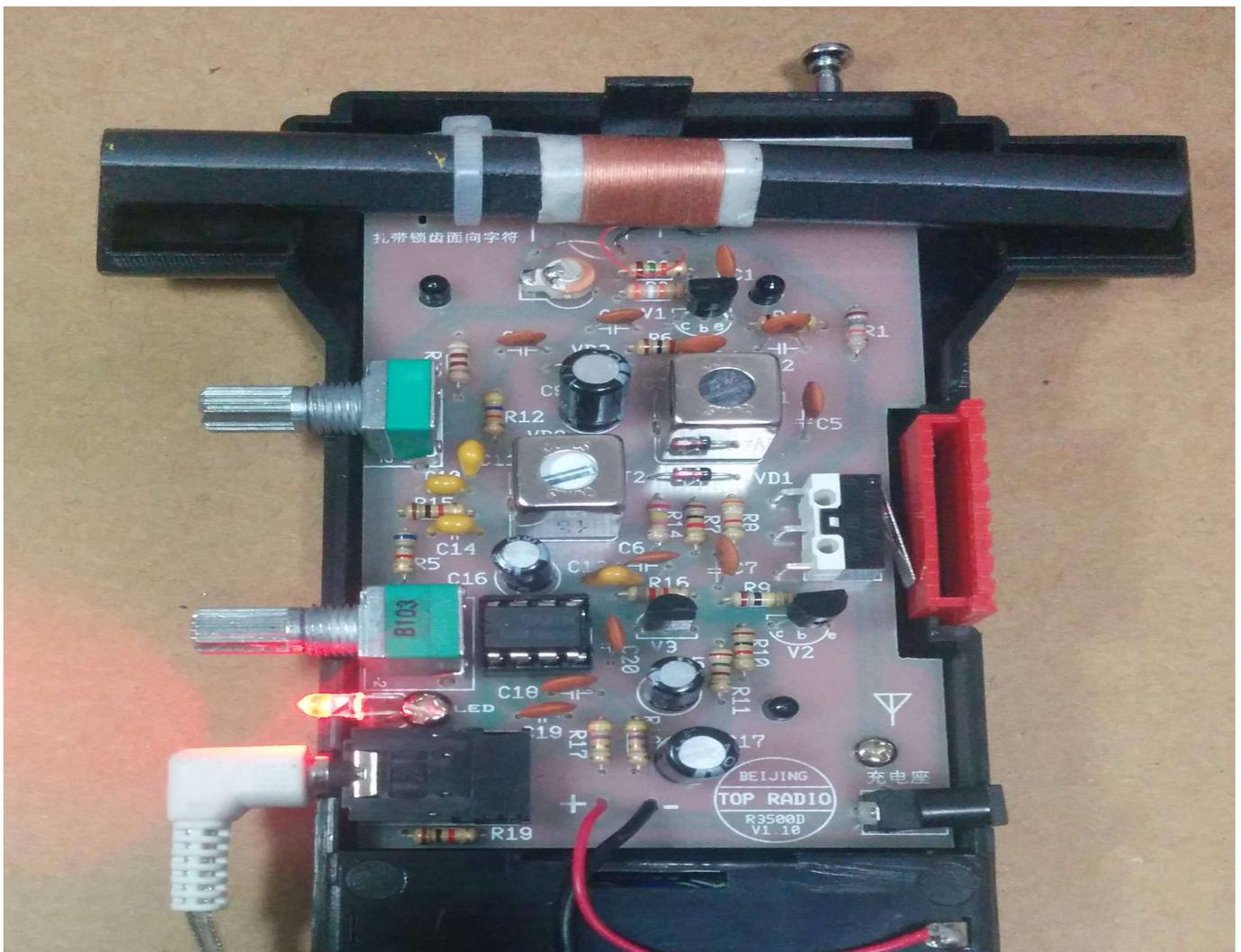
Receive a signal of 3.57 MHz from a signal generator or transmitter. Fine tune the cap of coil T1 (black) to peak the tone in the earphone. If no peak can be obtained but the volume is still increasing towards the extreme counter-clockwise position of the T2 cap, please replace capacitor C3 with a smaller value. If no peak can be obtained but the volume is still decrease towards the extreme clockwise position of T2 cap, please replace C3 with a greater value.



#### 5. Testing for directivity

Select an open field far away from power lines and constructions. Set a fox transmitter with a vertical antenna. Stand at a point of several tens meters away. Test the "8" figure characteristic of the receiver. (The two null points of some receiver sound little different, a clearer one shall be used for bearing.) Then add the vertical antenna for the cardio-pattern by pushing S1. Adjust the length of the telescope antenna to make better cardio-pattern, and remember which side is facing the transmitter for higher volume. If the cario-pattern can not be heard clearly, please try to change the value of R15, and test again. The minimum distance on which a cario-pattern can be maintained is 3 meters.

\* R3500D has a charger socket for charging rechargeable batteries. You don't have to take out the batteries for charging. However, there is no charging or protection circuit built-in, so please make sure the charger can match the voltage, polarity and type of the rechargeable batteries.



## Part List for R3500D ARDF Receiver Kit (1)

Item	Value	Identification and comments
R1*	18k, 5~20k	BRN-GRY-ORG-GLD
R2	15k	BRN-GRN-ORG-GLD
R3	39k	ORG-WHT-ORG-GLD
R4	1k	BRN-BLK-RED-GLD
R5	6.8k	BLU-GRY-RED-GLD
R6	1k	BRN-BLK-RED-GLD
R7	1k	BRN-BLK-RED-GLD
R8	3.9k	ORG-WHT-RED-GLD
R9	100k	BRN-BLK-YEL-GLD
R10	1k	BRN-BLK-RED-GLD
R11	150 ohm	BRN-GRN-BRN-GLD
R12	4.7k	YEL-VIO-RED-GLD
R13*	910 ohm or 820 ohm, 300~1.5k	WHT-BRN-BRN-GLD or GRY-RED-BRN-GLD
R14	24k	RED-YEL-ORG-GLD
R15	1k	BRN-BLK-RED-GLD
R16	8.2k or 8.0k	GRY-RED-RED-GLD
R17	4.7 ohm	YEL-VIO-GLD-GLD
R18	4.7 ohm	YEL-VIO-GLD-GLD
R19	1k	BRN-BLK-RED-GLD
RP1	10k	two gang pot - <b>Do not fit Washer and Nut</b>
RP2	10k	single gang pot - <b>Do not fit Washer and Nut</b>
CT	5-20p trimmer	Trimmer capacitor
C1	0.01μ	103
C2	4700p	472
C3*	47-68p	50
C4	4700p	472
C5	0.01μ	103
C6	0.01μ	103
C7	0.1μ	104
C8	0.01μ	103
C9	470μ	electrolytic capacitor
C10	100p	101, yellow, monolithic capacitor
C11	200p	201, yellow, monolithic capacitor
C12	1000p	102
C13	1000p	102, yellow, monolithic capacitor
C14	2200p	222, yellow, monolithic capacitor
C15	4.7μ	electrolytic capacitor
C16	10μ	electrolytic capacitor



**Part List for R3500D ARDF Receiver Kit (2)**

C17	470μ	electrolytic capacitor
C18	0.1μ	104
C19	0.1μ	104
C20	0.01μ	103
VD1	1N60	Glass body diode
VD2	FV1043	Glass body diode
VD3	3.5-4.4V Zener	Glass body diode
V1	9014	Transistor, TO-92
V2	9014	Transistor, TO-92
V3	9014	Transistor, TO-92
IC	TDA2822M	DIP8, with socket
T1	Shielded coil	black cap 31.4 uH Signal Frequency
T2	Shielded coil	white cap 65 uH Local Oscillator
S1	Antenna switch	PCB mount
S2	Part of earphone connector X	
X	Earphone connector	3.5mm stereo type, with earphone
W	Telescope antenna	
Misc.	Magnetic Ferrite Rod	Rod antenna, with winding 100uH <b>Note 2.</b>
	Screw set	<b>Long Screw for PCB to chassis – short for Case halves</b>
	Knobs and buttons	For S1, RP1 and RP2
	Plastic case	With battery holder for 4x AA size batteries
	Nylon strip	For fixing magnetic rod
	Earphone	With 3.5 mm diameter connector
	Printed manual	In Chinese, for alignment, please refer to this English manual. Also older PJ80 manual is useful.

<http://www.crkits.com/r3500dmanual.zip>

Link to older PJ80 Documentation:

<http://www.crkits.com/pj80kitbuilding.pdf>

Note that by design the LO frequency of the R3500 kits for 80 Meter is at Half of the Receive Frequency, ie runs from **1750-1800 kHz**. Success with the Kit!

Note 2: **IMPORTANT** - Magnetic (Ferrite) Rod Antenna.

Follow the instructions on the PCB. The center lead of the Rod is connected to GND. This is contrary to what is shown on the Chinese Circuit Diagram.

Note 3: **For 1.8 MHz Operation** fit additional 150pF capacitor in parallel with C3 and a 39pf capacitor in parallel with CT. Oscillator Frequency is now the same as Receive Frequency