

HT-1A Dual Band CW QRP Transceiver

Kit Building Instructions

Rev B, July 8, 2018

Designed by **BD4RG**

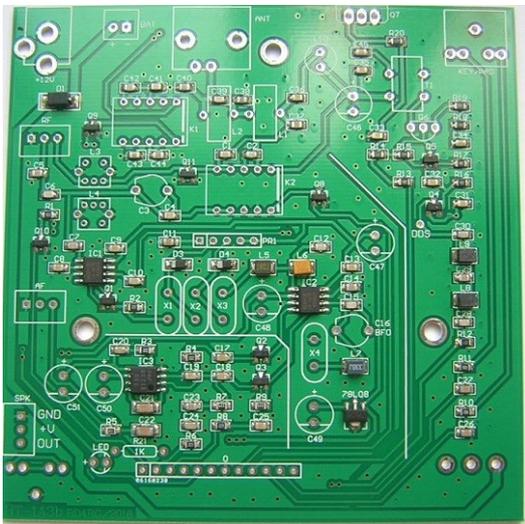
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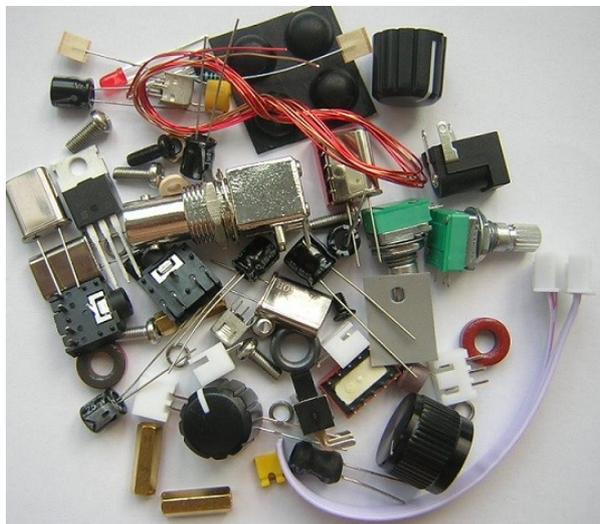
Refer to the user manual for specifications and operations

Overview

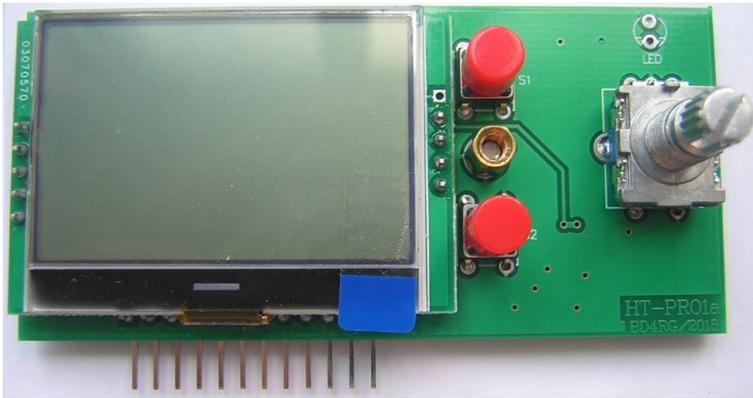
HT-1A is a dual band CW QRP transceiver in both kit and assembled kit forms. The kit contains the main board with all SMD parts pre-mounted, the assembled and aligned display board, all the through-hole parts, controls and case. Builders need to wind 3 toroids and install all the through-hole mounted parts. Please follow the following photos and instructions to assemble and align the kit.



The main board with all SMD parts pre-mounted



All the through-hole mounted parts



The assembled and aligned display board

Parts Inventory

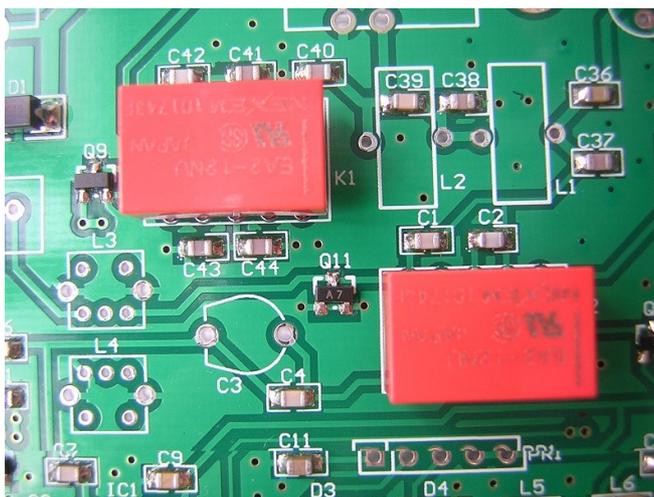
Attached is the part list of all through-hole parts and controls. If you find missing parts, contact your seller.

Item	Model/value	Qty	Marking on PCB
2-pin socket	XH2.54 2-pin	1	BAT
3-pin socket	XH2.54 3-pin	3	RF, AF, SPK
Phone jack	3.5mm 3F07	2	PHONE, KEY/PAD
DC in jack	5.5/2.1	1	+12V
Antenna connector	BNC	1	ANT
Fixed inductor	10uH	1	L10
Electrolytic capacitor	100uF	5	C46, C47, C49, C50, C51
Electrolytic capacitor	470uF	1	C48
Relay	EA2-12V	2	K1, K2
Toroid inductor	red	2	L1, L2
Toroid transformer	black	1	T1
Trimmer capacitor	40p (yellow)	1	C3
Trimmer capacitor	60p (brown)	1	C16 (BFO)
Enameled wire	0.4mm diameter	2	Red and yellow, one each
Transistor	2N4401	1	Q6
MOSFET	IRF510	1	Q7
Crystal	4.9152M	4	X1, X2, X3, X4
Resistor pack	A104J	1	PR1
Fixed resistor	1K	1	R21
Shielded variable inductor	6*6	2	L3, L4
LED	3mm red	2	For transmitting status, and AGC circuit
Volume control	1K	2	RF or AF. Only one is used (default to AF), the other one can be reserved as spare part. See modification part in this manual.
Power switch		1	S1
Volume knob	black	2	One is spare.
Encoder knob	black	1	For tuning encoder
3-pin header wire		2	
Pin header jumper	yellow	1	

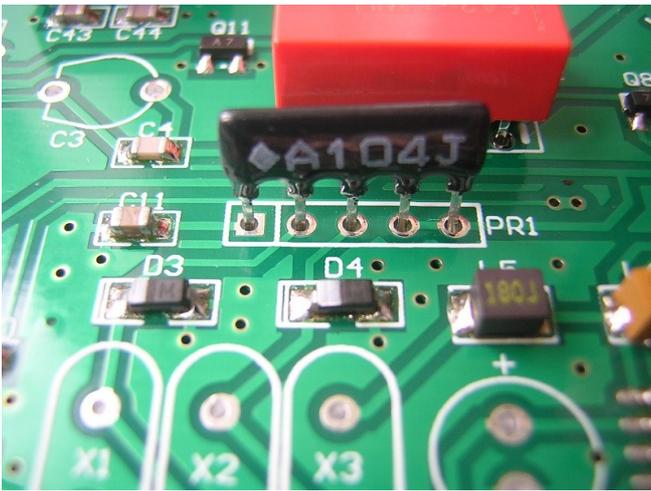
3mm*5 (black) screw	To fix display board	1	Flat head
3mm*8 (black) screw	To fix Q7	1	Pan head
3mm nut	To fix Q7	1	
Thermal pad	To fix Q7	1	
Thermal washer	To fix Q7	1	
14mm standoff	To fix battery board	3	
3*8 screw	To fix battery board	6	
3mm spring washer	To fix battery board	6	
Rubber case foot		4	With back paste
Assembled and aligned display board		1	
Main board with all SMD parts pre-mounted		1	
PCB for holding battery pack and audio amplifier		1	
Customized case		1 set	

Building Instructions

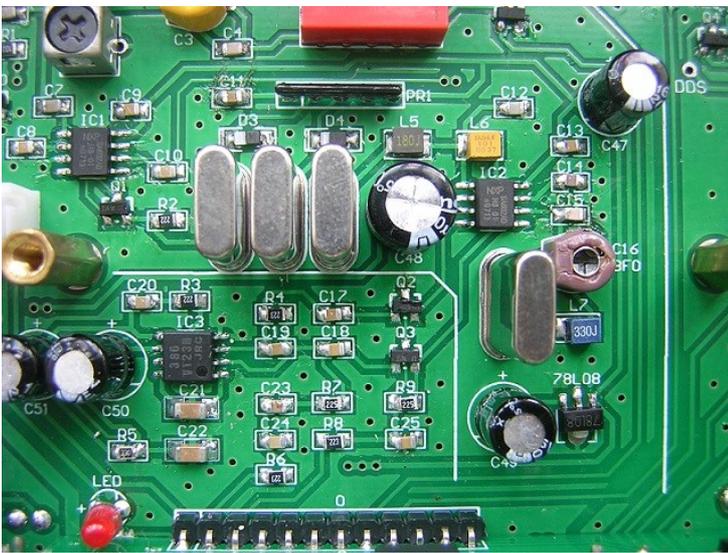
Observe the main board to make sure all the SMD parts are properly mounted. If you observe bad parts or bad soldering, please report the issue to the seller and take necessary measures to fix it before you go further. [You can watch the video https://youtu.be/3N7Ezabt5kk](https://youtu.be/3N7Ezabt5kk) to build the kit, or follow the following instructions.



Note the orientation of the two relays K1 and K2. Align the lines on the relay (on the right side) and the PCB.



Install the resistor pack RP1 in this direction.



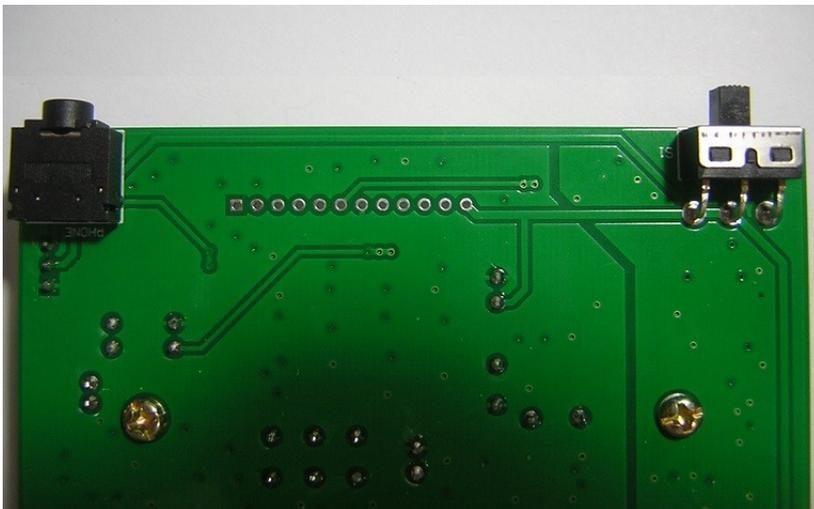
Only C48 is 470uF, and all other polarized electrolytic capacitors are 100uF. The longer lead is the positive, so install it to the side with + marking. Follow the part list to solder the electrolytic capacitors C46-C51, the trimmer capacitors C3 and C16, the shielded coils L3 and L4, the sockets RF, AF, SPK, and BAT, the crystals X1-X4, the fixed inductor L10, the BNC antenna connector, the DC in jack, the KEY/PADDLE jack, Q6, LED (Plug in the long lead of one red LED to the left side with + marking and solder, as shown above) and R21 (1k, near LED, not shown in the above photo).



Wind the toroids as the above. L1 is 10 turns wound on the red toroid, and L2 is 12 turns wound on the red toroid, while T1 is a transformer wound on the black toroid, with 8 turns of primary winding, and 2 turns of secondary winding. Tin the wire ends before they are soldered to the PCB.



The 8 turns primary winding of T1 are installed near Q6, while the 2 turns secondary winding of T1 are installed near Q7.



Phone jack and power switch are soldered on the back side of the PCB.



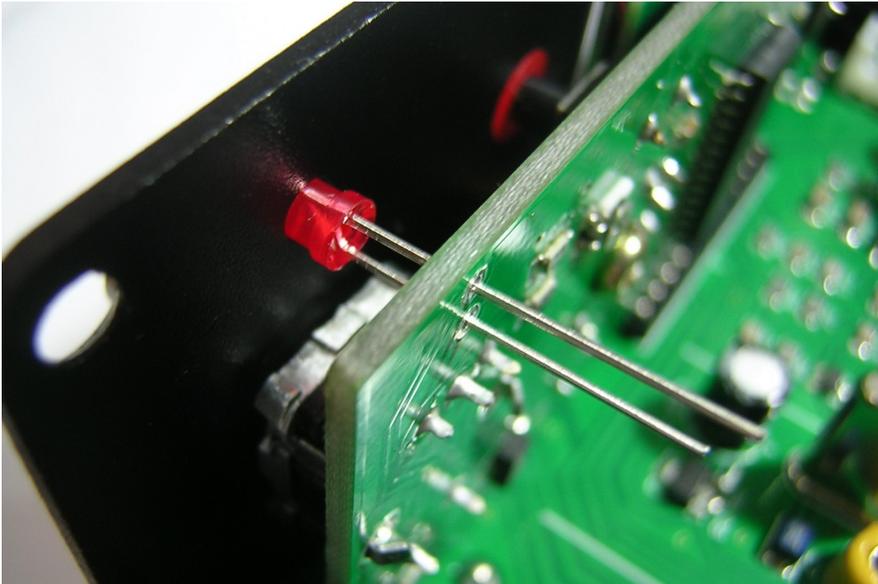
Plug in the display board to the main board. Leave no spacing between two boards and make them vertical. Check and solder.



Plug in the final transistor Q7 to the PCB, but don't solder yet. Install the rear panel, and align the hole on the Q7 with the mounting hole on the panel.



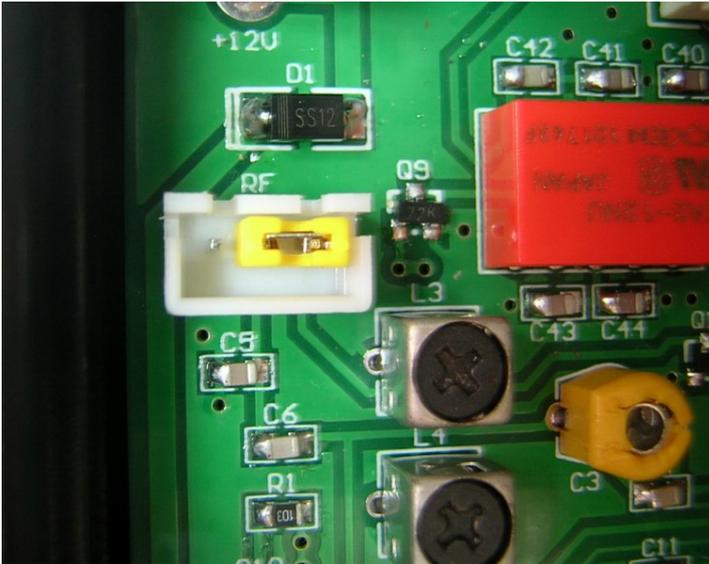
Put in a thermal pad between Q7 and the panel, plug in the screw and put on the thermal washer and tighten with nut. Now solder Q7 pins to PCB.



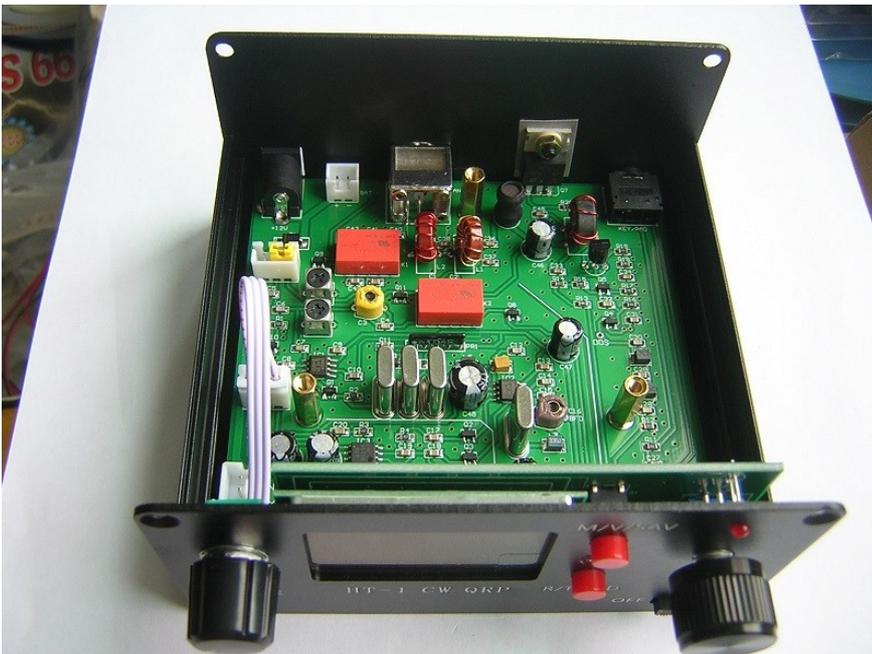
Install the front panel. Before installation, it is recommended to remove the LCD protective film, and plug in the LED as the photo (note the longer lead on the top side). Fix the front panel with screws and leave necessary protruding part of LED and then solder.



Solder a 3-pin header wire to one of the gain control potentiometers, following the above orientation to plug in the AF socket, and mount the potentiometer to the front panel (trim the positioning protruding part on the potentiometer before mounting).



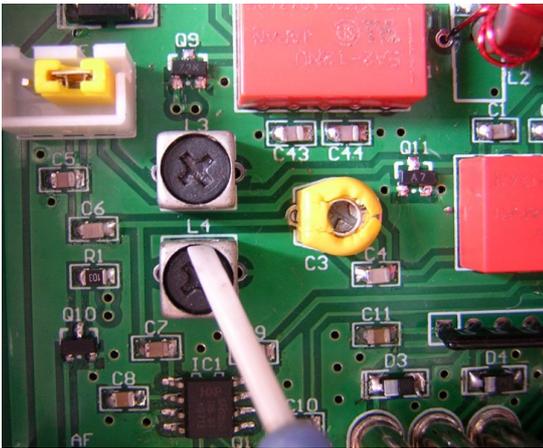
Plug in the pin header jumper to the RF socket like above (on 2-pin right side). (If you wish to control RF and fix AF gain, you can plug in the potentiometer into the RF socket and plug in the pin header jumper into the same place of the AF socket.)



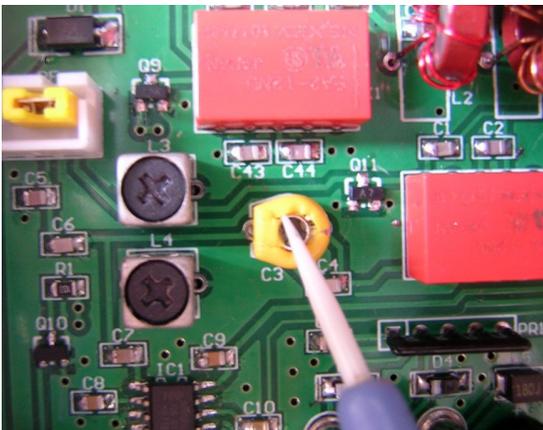
Install three standoffs using screws and spring washers. Complete the kit building as the above.

Check all the soldering joints for cold soldering or solder bridges. If no problem, apply power supply and turn on power switch to see if the display works fine. Check the overall current consumption to see if it is around 60mA. If everything is okay, you can proceed to alignment.

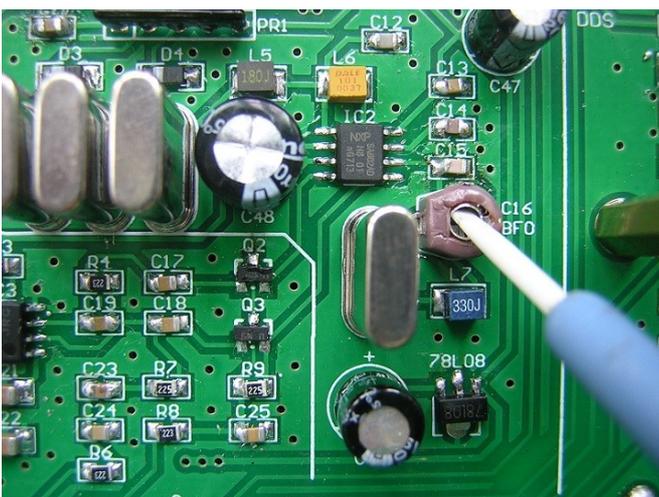
Alignment



Power on the assembled kit and tune to 14.060 MHz. Adjust these two variable inductors L3 and L4 to peak the sensitivity of 20m band. If you don't have a signal generator, connect an antenna and you can judge it by the band noise or signal level.



Tune to 7.030 MHz. Adjust this trimmer capacitor C3 to peak the sensitivity of 40m band. If you don't have a signal generator, connect an antenna and you can judge it by the band noise or signal level.



Adjust the trimmer capacitor C16 to make the received CW signal pitch at around the default side tone 600Hz (If you have chosen 500 or 700 Hz side tone, you need to adjust C16 to make sure the CW signal pitch is near the chosen side tone), or you can choose a SSB signal on the exact kHz frequency to adjust to normal tone. If you are serious, you can use audio spectrum analyzer apps on your smart phone to help tuning the pass band of CW and SSB modes.

As long as the parts quality is okay and soldering is no problem, normally you don't need to align the transmitter. It

normally puts 4-5 watts at 12V power supply with current consumption at around 800 mA (in the normal range of 700~900mA). If you observe abnormal current consumption, you can adjust the spacing of the turns on L2 (the smaller spacing, the bigger current).

The trimmer resistor VR1 on the display board is used to calibrate the power supply voltage. It was calibrated in factory, but if there is big tolerance, you can adjust by yourself.

Modification suggestions

Warning: It is at your own risk if you modify the transceiver and it will void the warranty if something goes wrong. The speaker connector on the main board is not directly for connecting the built-in speaker, instead it is used to connect the audio amplifier circuit on the battery board. The battery connector on the main board is not protected against short circuit or over charging or over discharging.

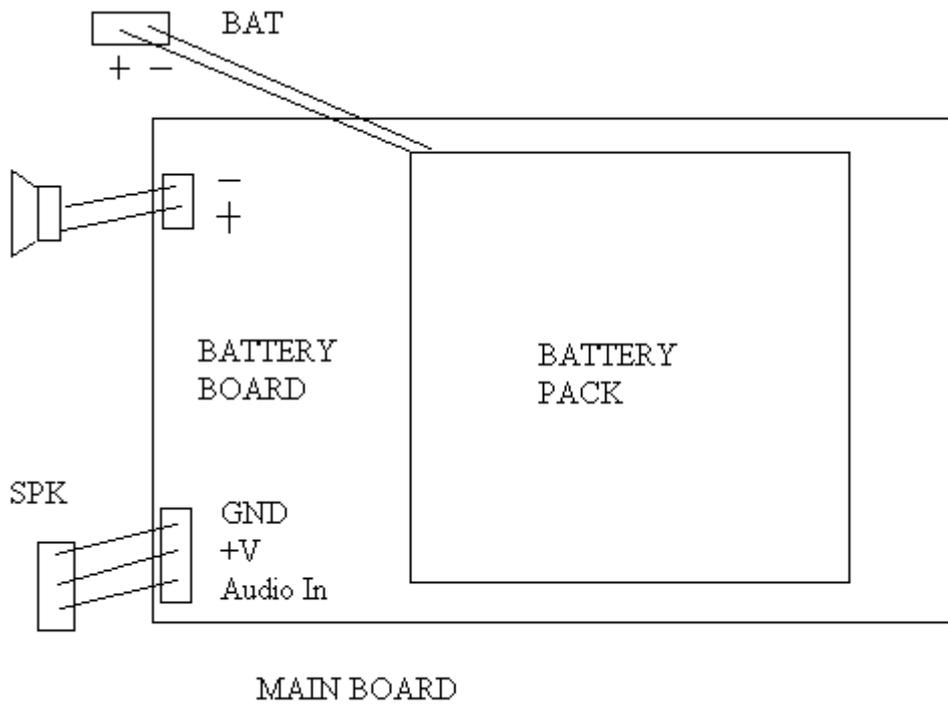
Change Gain control to RF attenuator

The receiver front end is the input stage of an NE602 mixer. If you have concern on the strong signal handling capability, you can easily change the control on the front panel from AF gain control to RF attenuator. Just pull out the yellow pin header jumper from the RF socket, plug the potentiometer to the RF socket, and plug the yellow pin header jumper to the same place (2-pin on the right side) of the AF socket. The drawback of this modification is that the S-meter will be impacted if you control RF, and you cannot completely turn down the noise, especially for 20m band. If you wish to have both RF and AF controls, you can drill a hole on the rear panel and install the spare potentiometer. Plug the rear potentiometer to the RF socket and front potentiometer the AF socket. Now the pin header jumper is no longer used.

Add an built-in speaker and/or a battery pack

You can install the battery board with 3 screws to the standoffs on the main board. Fix a battery pack of 3S 18650 Li-ion battery or similar 12V battery pack to the PCB with nylon cable ties and plug in the battery wires to the BAT socket on the battery pack. **Warning:** You must be absolutely sure about the polarization before you apply the battery pack to the main board. See the marking on the PCB. Once you install the battery pack, the DC in jack is no longer used to power the radio. Instead it is only used to charge the built-in battery pack with proper external battery charger.

On the left side of the battery board, you can install an audio amplifier circuit based on LM386. It is used to further amplify the headphone signal to drive a built-in speaker which you can drill holes on the case and install by yourself. The power supply of the audio amplifier comes from the mid pin of the 3-pin SPK socket on the main board. See the following diagram to wire the circuit. **Always take care to handle battery wires or +V signals to avoid short circuit or damage.**



HT-1A BATTERY PACK AND SPEAKER MOD