

SDR-3

SSB Transceiver experiment kit Assembly manual

2018/Aug/15 version 1.00

Ojisankoubou

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■ Important explanation items (Please be sure to read through)

- Even if you suffer damage or damage directly or indirectly by using this kit, we will not compensate at all.
- We will not respond to exchange, warranty, refund, even if you failed to assemble or fail in use.
- This kit aims to provide hardware that can be used in general purpose. The one exemplified as being able to make with this kit shows the possibility of this kit. I did not actually make all of the exemplifications.
- Characteristics and performance listed in this manual, Transistor Gijutsu magazine, website, etc. are only one production example, and not all the kits guarantee the same performance. Please be aware that there are cases where it may be good or bad.
- Although we are carefully designing, there is no guarantee that there are no serious design errors or bugs.
- Circuits, parts, board, software, etc. may be changed without notice.
- This manual is English translation from the Japanese version of the manual.
what the English language version of the Terms says and Japanese language version says, then the Japanese language version shall take precedence.

■ Before assembling

- Please make sure that all parts are included (see the parts list). If there are missing parts please contact us before assembly.
- Assembly and confirmation will be done surely step by step. In case of trouble it will not go to the next step until it is fixed. This is the best way to ensure complete completion.
- Print all the pages and place a check mark in the place where you finished. It is good to take notes of what you noticed as appropriate.
- It is good to start by reading all the assembly procedure and grasp the whole image.

■ Information / Software Location

The latest information is available at the following site.

Ojisankoubou Website
<http://ojisankoubou.web.fc2.com/>
Transistor Gijutsu Website
<http://toragi.cqpub.co.jp/>

The software used in this manual is the one at the time of writing this manual. It may be changed at the point of sale.

■ Tools and others required for assembly

- Solder (solder containing lead is easy to use)
- Soldering iron (recommended one with about 60 ~ 80 W with temperature control)
- Electronic tool such as nipper, driver (# 1, # 2)
- DC power supply (φ2.1 center plus 5 V)
If the noise of the power supply is large, the performance deteriorates. Transformer type CVCC power supply is recommended. Those that were dropped by a transformer and then set to 5 V with a series regulator, is OK.

Please drop the noise sufficiently when using the switching regulator.

- Digital Multimeter
- USB to serial conversion module and connection cable
- PC (We confirmed with window10 pro)
- Speaker with amplifier, or headphone
- Microphone + SW (PTT) parts
- 2 knobs (D axis)

■ Precautions for Assembling

■ In soldering, it is a habit to supply solder after raising the temperature of the part to be soldered sufficiently. It is good to do with an image of about 2 seconds after soldering for 2 seconds by placing a soldering iron at the place to be soldered. Please lower the temperature of the soldering iron if the solder will come up quickly.

■ Please be careful not to apply force to the land with a soldering iron. Even when moving over the land with a soldering iron, make sure that the tip of the soldering iron does not hit the land strongly. Especially the force in the short direction of the land is prohibited. The land has a minimum width of only 0.25 mm, and once it peels off it is very difficult to repair.

■ Make sure that each soldering point is checked with a loupe (whether it is not a loose solder, bridge or solder ball) at each stage. If soldering is not good, it may not work afterward even if it works once. Especially trouble with power supply directly leads to destruction of IC etc.

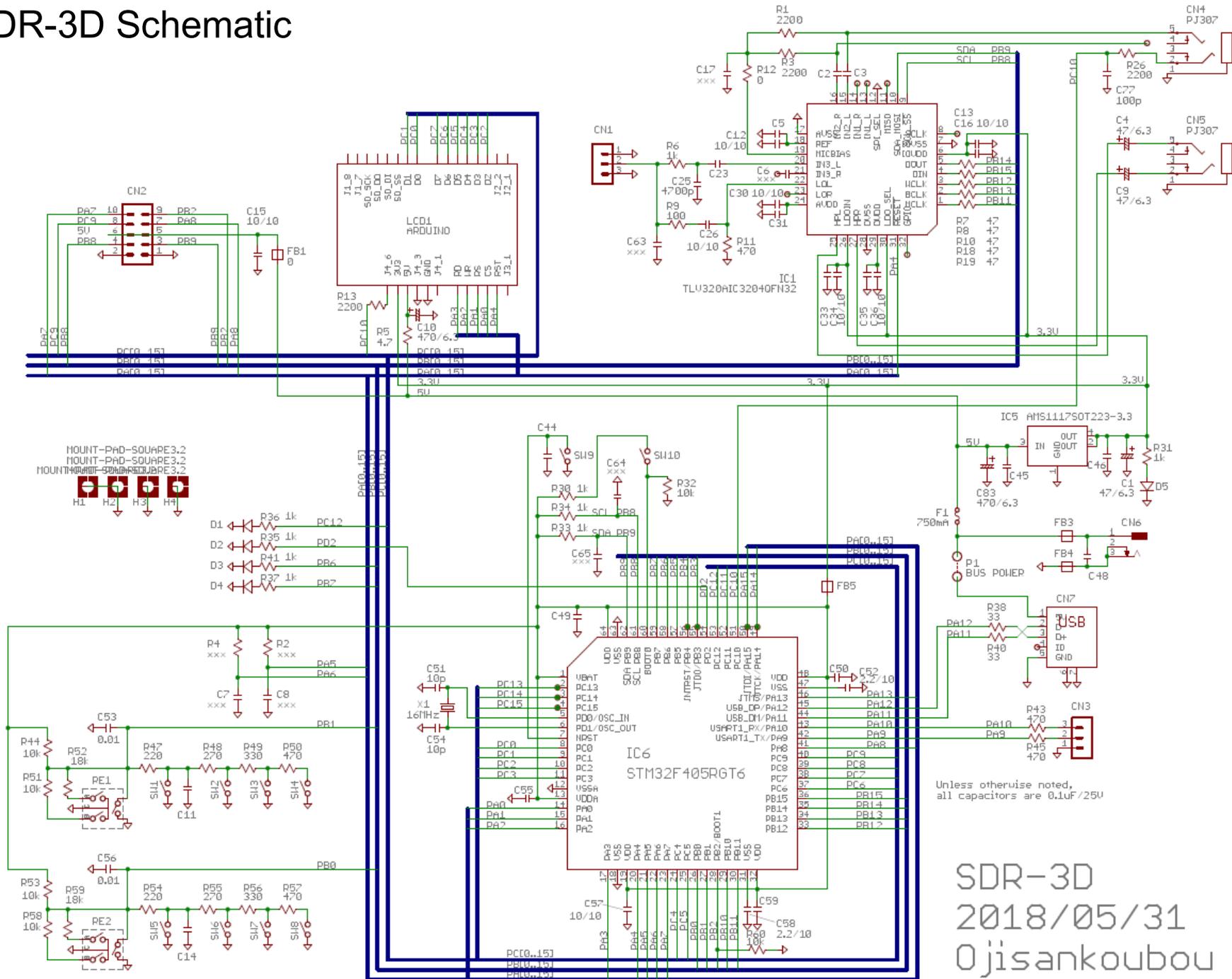
■ There are parts that are sensitive to static electricity. Please take measures such as raising the humidity of the room, hand washing, letting static electricity escape before touching parts. However, it is not necessary to become so nervous except when there is static discharge in winter season.

■ Parts List

SDR-3D board(SMD parts mounted)	1
SDR-3A board (SMD parts mounted)	1
Rotary Encoder with SW	2
Tactile SW	10
LCD 320x240 with touch	1
MIC/HEADPHONE JACK PJ307	2
DC POWER JACK 2.1mm	1
PIN SOCKET 1x42pin	1
PIN HEADER 1x40pin	1
PIN HEADER 2x32pin	1
inductor 4.7u 10% axial 0410	3
Relay 5V DPDT	2
BNC connector 90degree angle	1
Ferrite core	4
UEW wire ϕ 0.18mm	2m
Copper adhesive tape	20cm
IDC 10pin cable	1
shield wire 1 core	30cm
screw M3	8
spacer M3 10mm	8

- Please check first whether all parts are included.
- If there are missing parts, please contact us before start assembly.

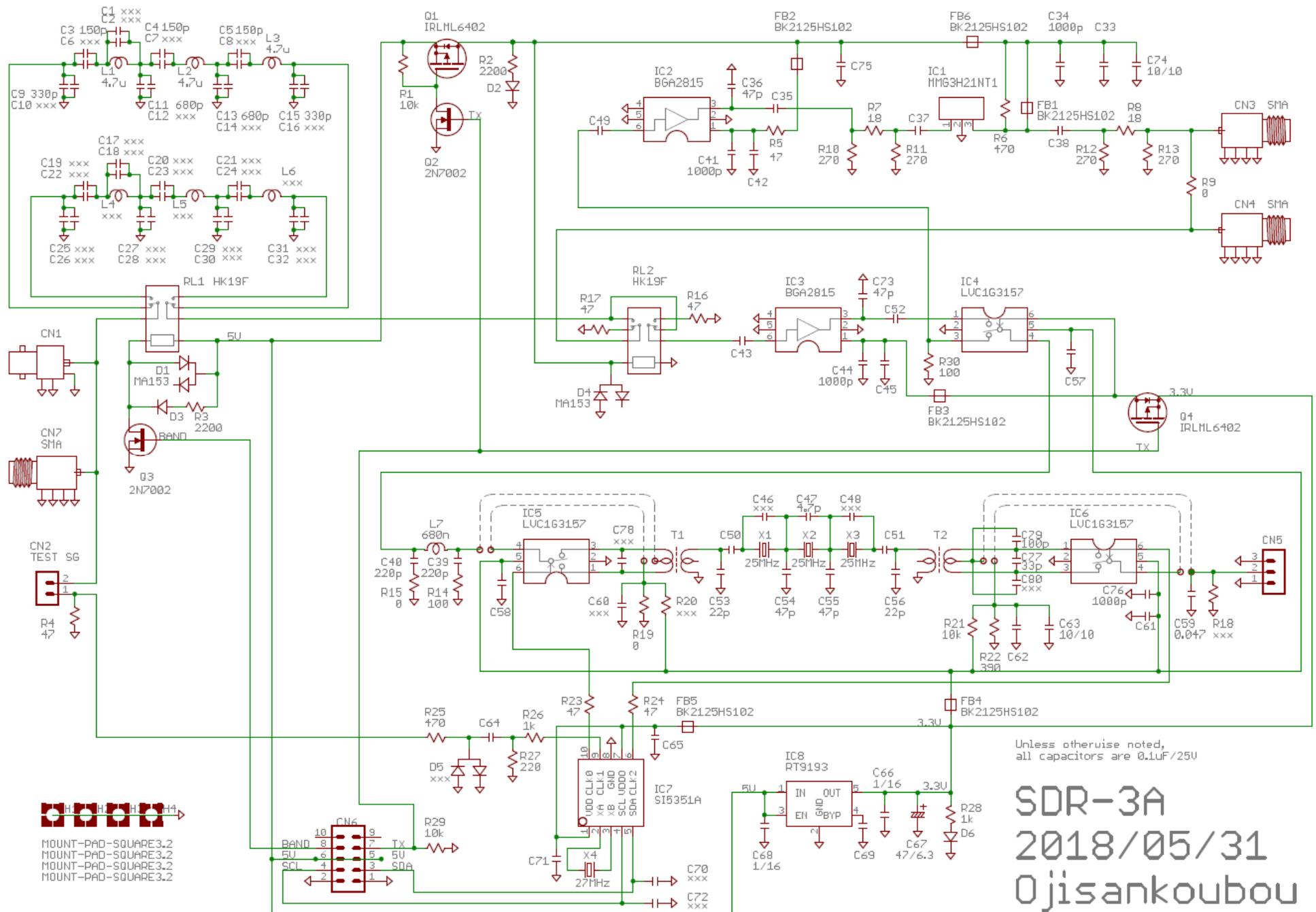
SDR-3D Schematic



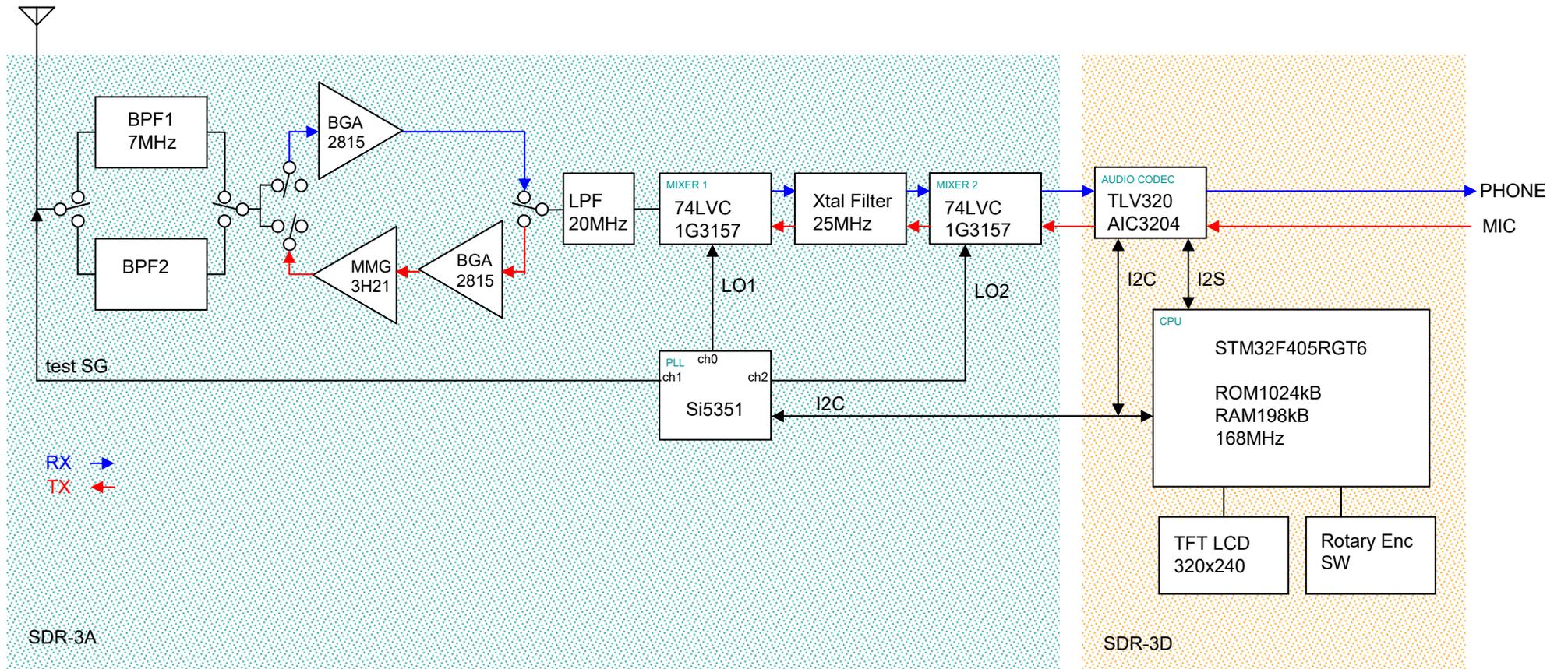
Unless otherwise noted, all capacitors are 0.1uF/25V

SDR-3D
2018/05/31
Ojisankoubou

SDR-3A Schamatic



SDR-3 Hardware Block Diagram



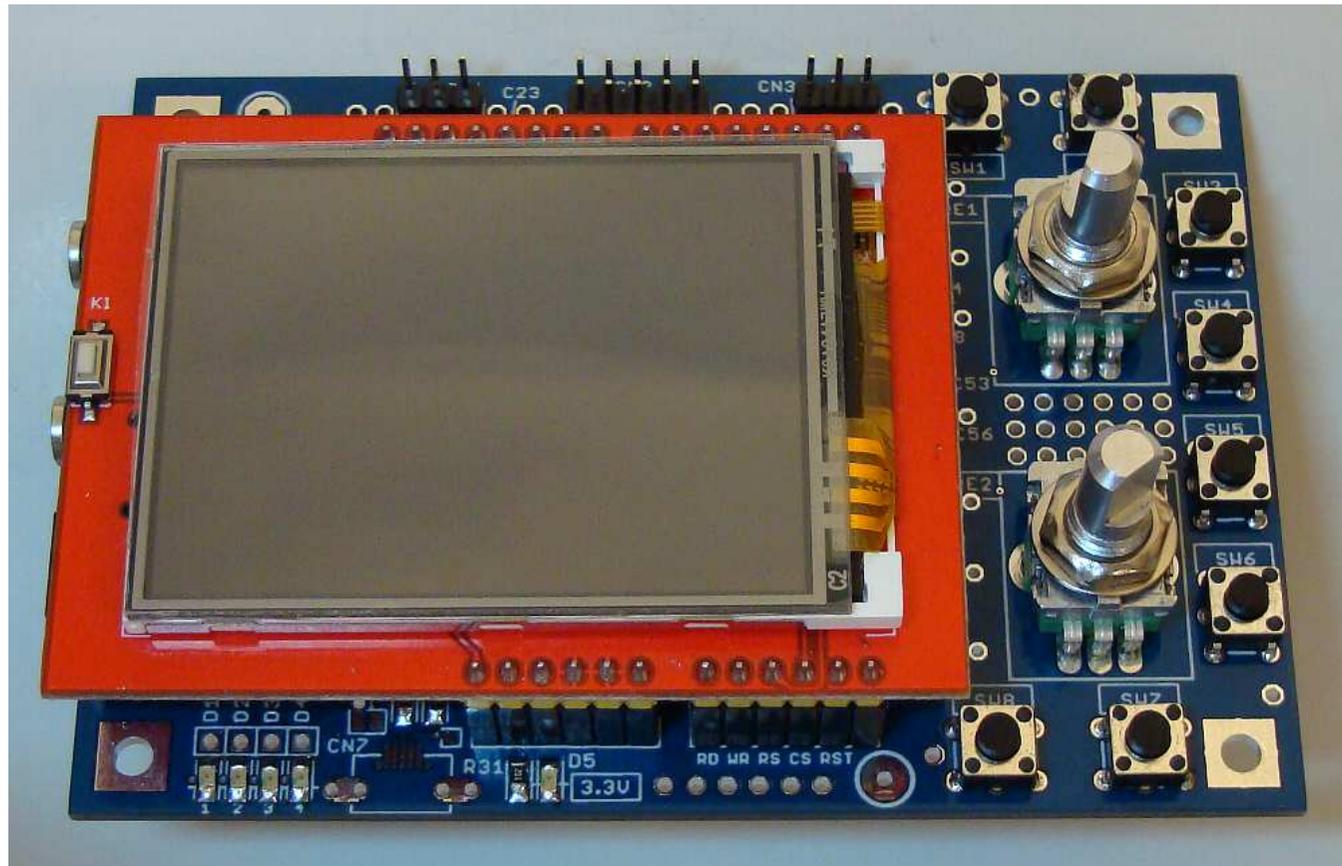
1 . Assembling SDR-3D

This kit consists of two boards, SDR-3D board and SDR-3A board.
The SDR-3D board is responsible for the digital part, and the SDR-3A board is for the analog part.

First assemble the SDR-3D board, then assemble the SDR-3A board.

Follow the steps one by one. If it does not work, do not go ahead and make sure that it works properly in that step.

Photo of completed SDR-3D board



1 - 1 . SDR-3D Power supply, microcomputer peripheral parts Soldering

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First of all, solder only one pin and confirm from various angles whether parts are floating or not inclined.

If there is a float or tilt, correct soldering parts by pressing them with finger while soldering.

Solder the rest if there is no tilt.

It is good to temporarily fix parts with masking tape.

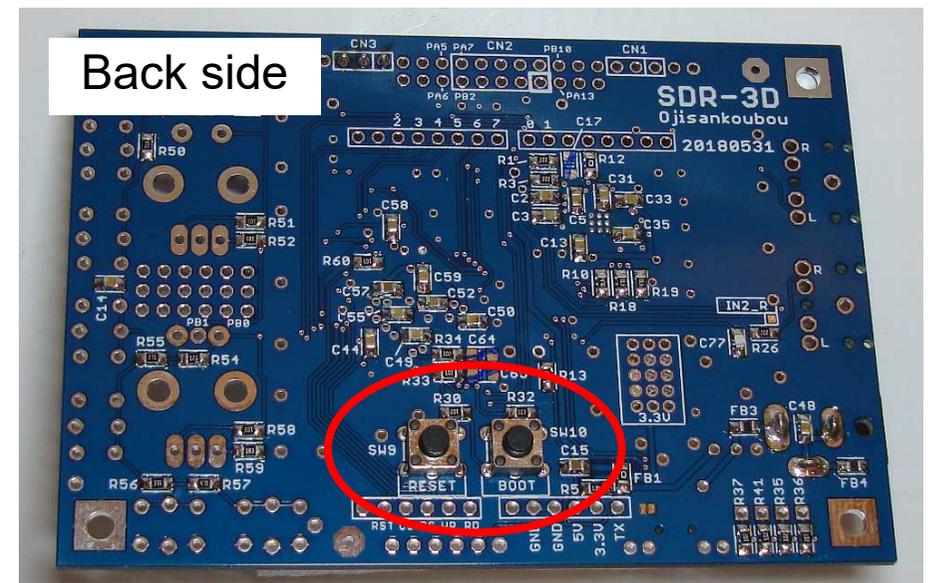
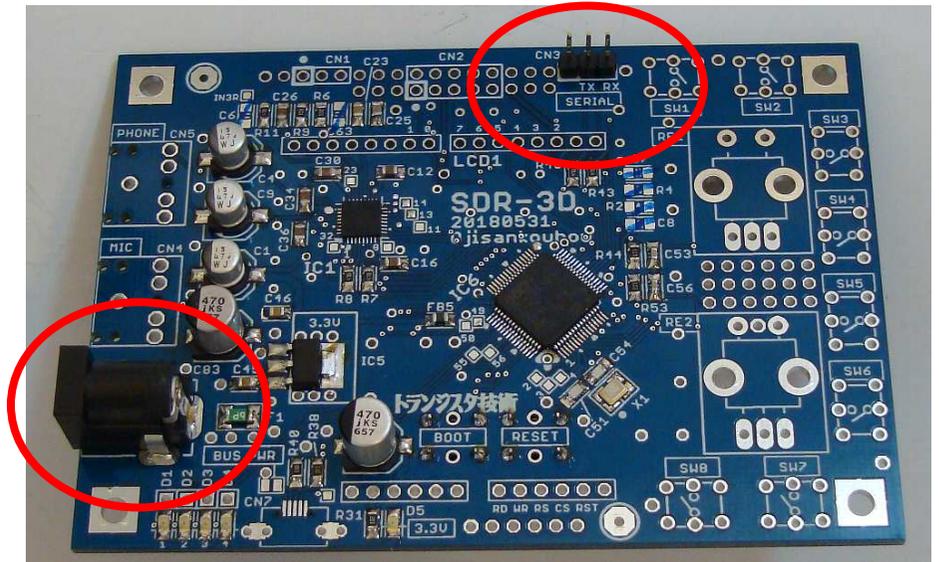
CN6 Power Connector

CN3 3pin header

Cut the 3 x 1 pin header included with the kit and use it.
If you scratch the groove with a cutter, it will break easily.
Soldering is easy if temporarily tacked with masking tape.

SW9、SW10

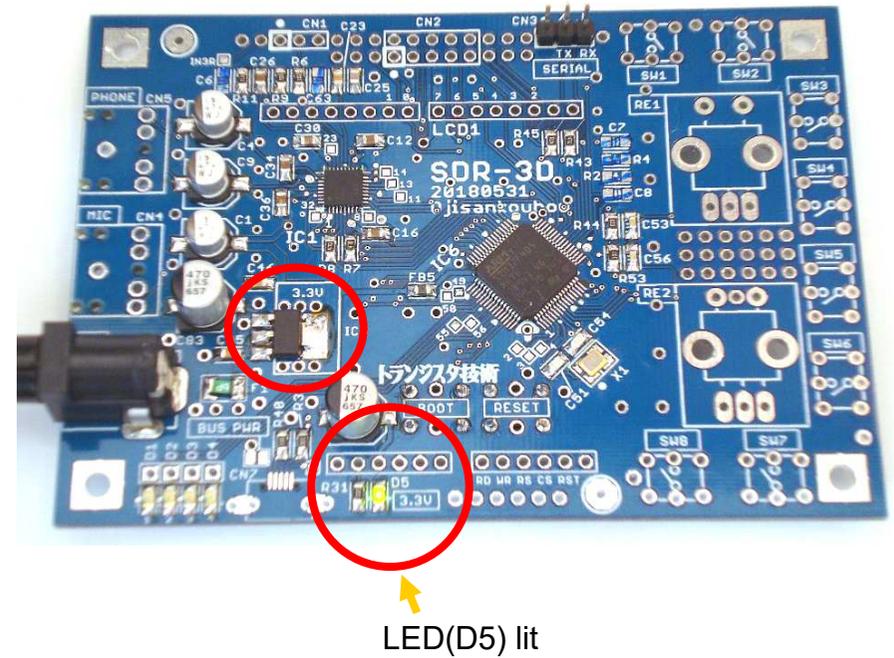
Attach them to the back of the board (see right picture).



1 - 2 . SDR-3D Power supply operation check

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1. Connect the 5 V power supply (center plus) to the SDR-3D board.
2. Using the multimeter, check that the voltage of IC 5 fin is 3.3 ± 0.1 V.
3. LED lighting check
 - Check that D5 lights up.



1 - 3 . SDR-3D Writing program to microcomputer 1

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1. Connect the SDR-3D board and the PC with a USB to serial conversion module (not included in the kit).

Look at the silk print written on the USB-to-serial conversion module and make the following connection cable.

- ① pin USB-Serial conversion GND ↔ SDR-3D board CN 3 ① pin GND
- ② pin USB-Serial conversion RX ← SDR-3D board CN 3 ② pin TX
- ③ pin USB-Serial conversion TX → SDR-3D board CN 3 ③ pin RX

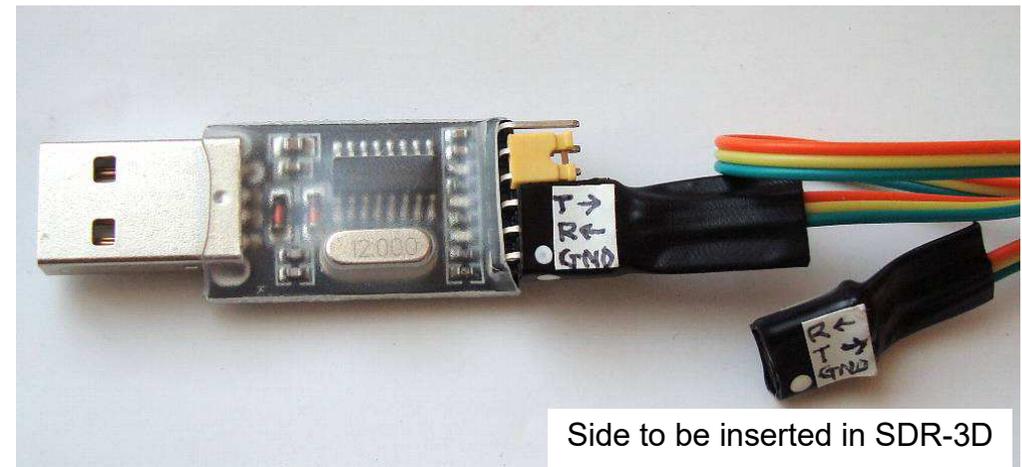
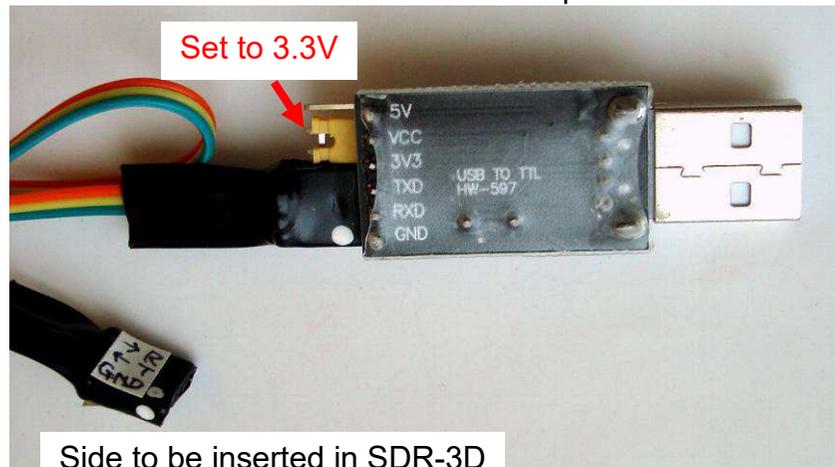
Use USB-serial conversion module CMOS 3.3 V or TTL output level.

■ notice ■

You can not use the USB-RS232C conversion module (if used, the board will be broken).

The RS232C terminal of the PC can not be used (the board is broken when used).

USB to serial conversion module example



1 - 3 . SDR-3D Writing program to microcomputer 2

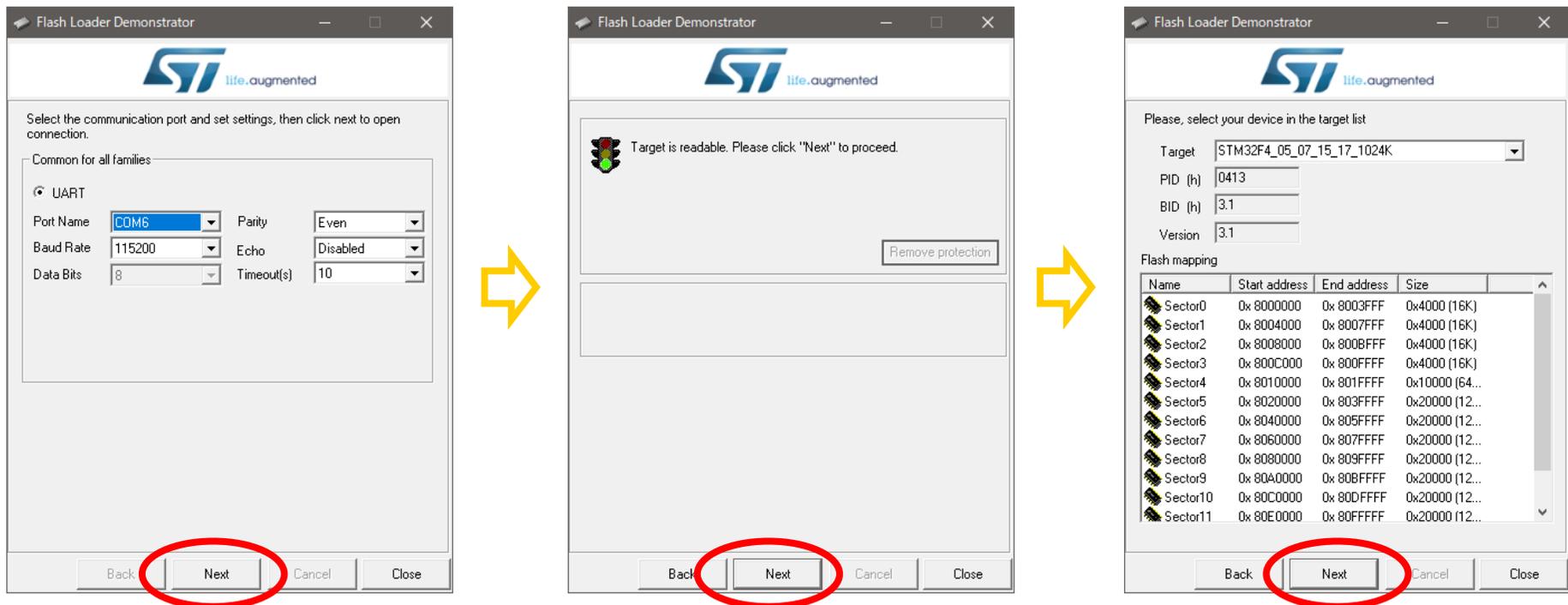
1. Please download FlashLoaderDemonstrator from STmicro's site below and install it on PC.
<http://www.st.com/en/development-tools/flasher-stm32.html>

When it is executed, it becomes the lower left screen (The screen is a setting example. Please make the COM number of connected USB-serial module).

- 2. Press RESET (SW 9) and BOOT (SW 10) on the SDR-3D board
 - ① First release RESET (SW 9).
 - ② Next, release BOOT (SW 10).

The STM32F405 microcomputer on the SDR-3D board is now in BOOT mode.

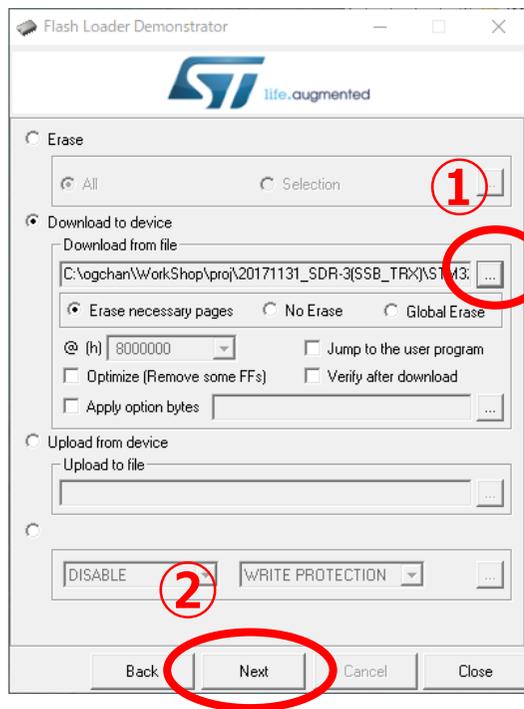
3. When you press the Next button of FlashLoaderDemonstrator, the screen transitions as follows.
If OK, go to step 4 on the next page. In case of error, go to the page "Trouble shooting".



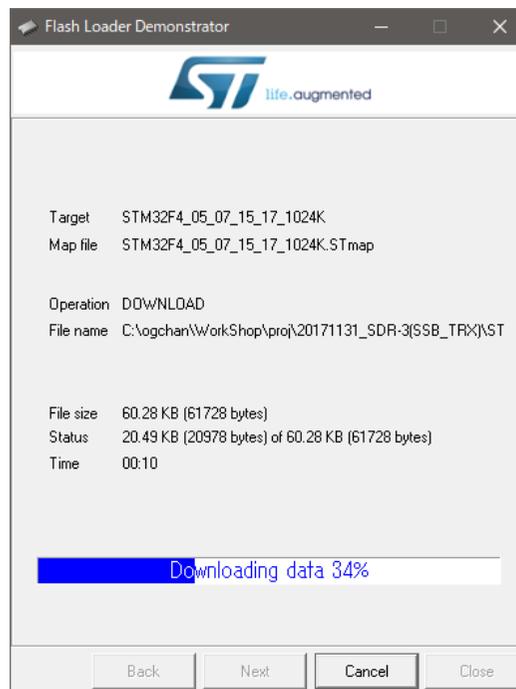
1 - 3 . SDR-3D Writing program to microcomputer 3

- 4. When you are at the bottom left screen, press the file selection button at "Download from file". Since the file selection screen appears, specify mainxxxx.hex (xxxx is the version number) file in the executable file folder.
- 5. Press the Next button to start writing.
- 6. Close the program when writing is completed normally.

- ① After file selection,
- ② Press the NEXT button



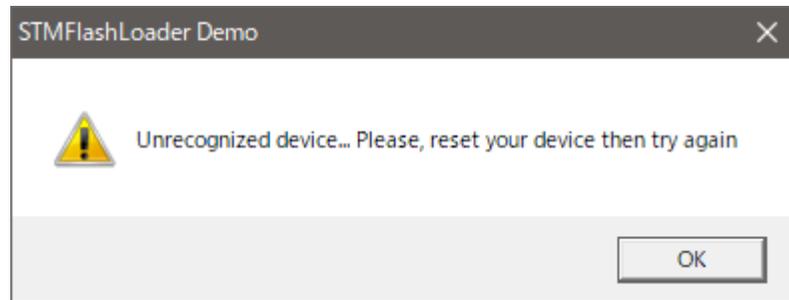
Writing



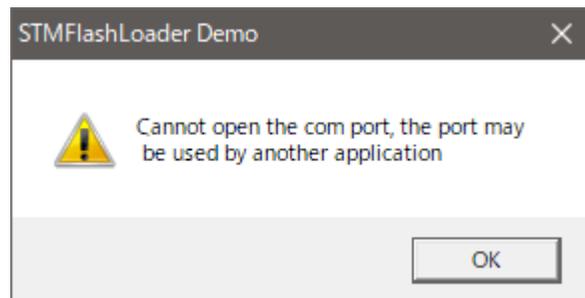
Successfully written



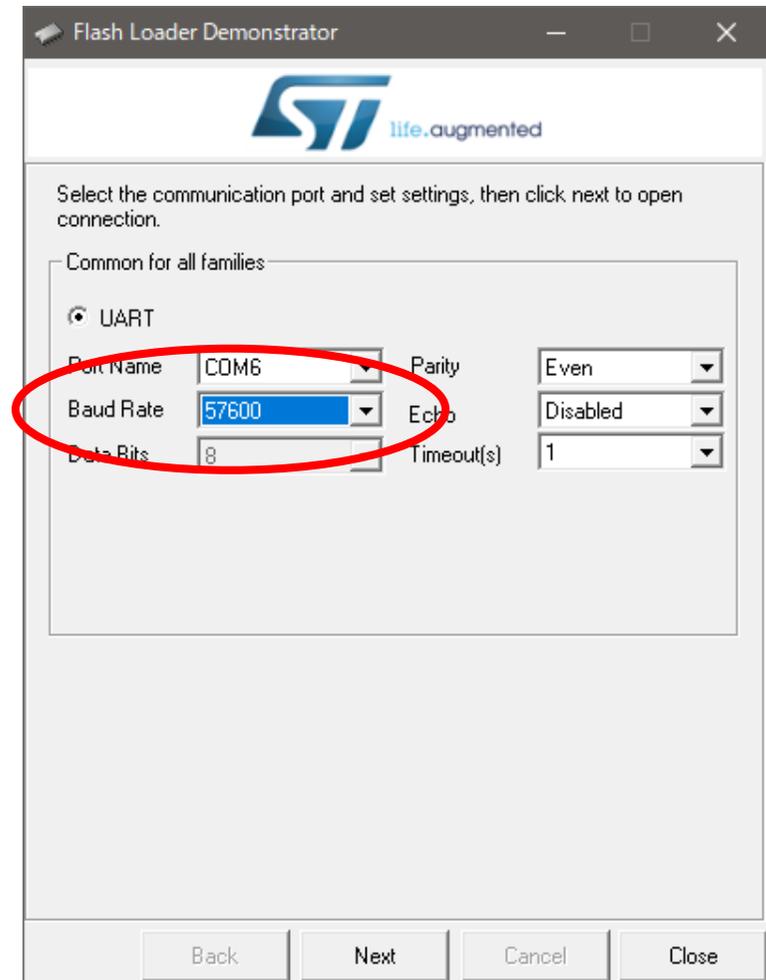
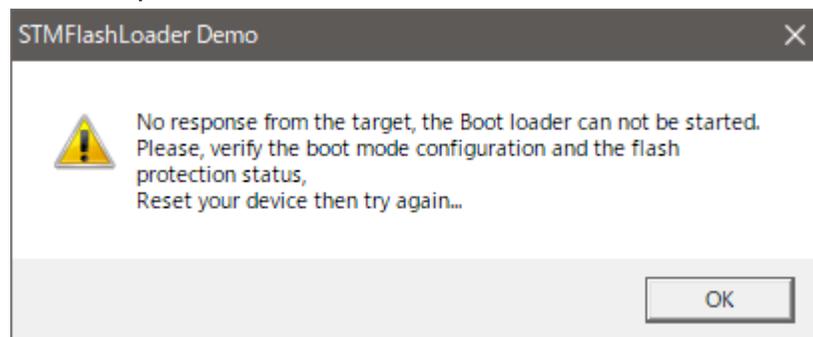
If the error below appears, please slow down the communication speed and try it.



If the error below appears, please make sure that Port Name is the PORT number of USB-serial conversion module.



If the error below appears, check the serial connection and repeat from step 2.



1 - 3 . SDR-3D Writing program to microcomputer 4

7. Press RESET (SW 9) on SDR-3D board.

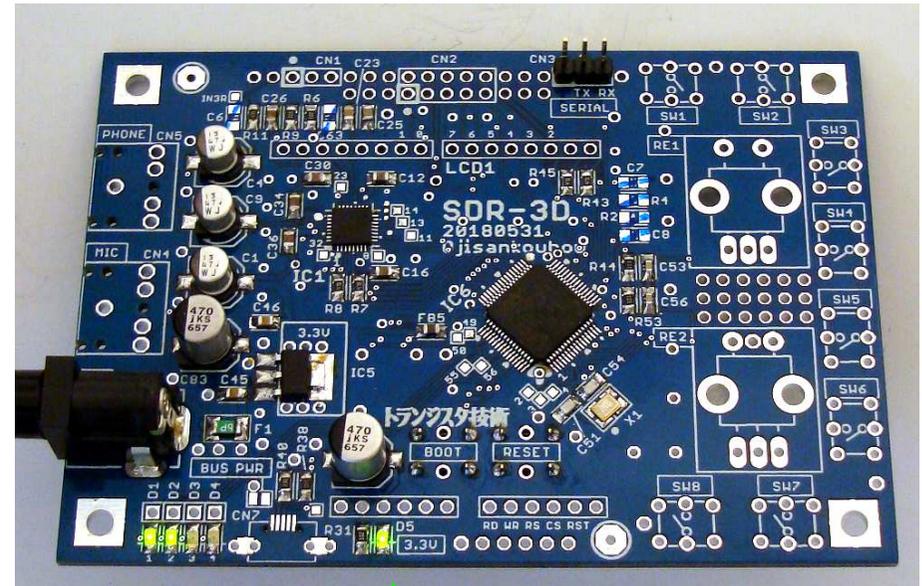
All of D1 to D4 are lit at the beginning.

D1 then blinks in 0.5 seconds.

D2 to D4 are for microcomputer debugging. It will be turned on or off depending on the mode and operation.

When D1 lights up and does not blink

→ Check the soldering from IC6 53pin to R36, D1.



LED(D1)0.5sec
blinking

LED(D5) lit

1 - 4 . SDR-3D Terminal connection (option)

If you have terminal software (the screen below is TeraTerm), connect to the SDR-3D board using USB-serial (used for programming) at 115 kbps and reset (press SW 9) . You can see the log at startup (FlashLoaderDemonstrator has been closed beforehand).

There are still a lot of errors since LCD and SDR-3A boards are not connected yet, but this is normal. Finally the error will be gone (maybe).

If an error log can be obtained by connecting a terminal when something goes wrong, it becomes a clue to solving.

```
COM6:115200baud - Tera Term VT
ファイル(F) 編集(E) 設定(S) コントロール(O) ウィンドウ(W) ヘルプ(H)
00=00000000
BF=BFBFBFBF
D3=D3D3D3D3
*** ERROR: I2C1 (adr=C0) ***
8828909
SDR-3_TR20180322 20180411 SSB_TRX
ch memory restored
*** ERROR: I2C1 (adr=C0) ***
*** ERROR: I2C1 (adr=30) ***
*** ERROR: I2C1 (adr=C0) ***
>STACK REMAIN: 1328
```

1 - 5 . SDR-3D Other parts Soldering

First of all, solder only one pin and confirm from various angles whether parts are floating or not inclined.

If there is a float or tilt, correct soldering parts by pressing them with finger while soldering.

Solder the rest if there is no tilt.

It is good to temporarily fix parts with masking tape.

- CN 4, CN 5
- CN 1 3 pin header

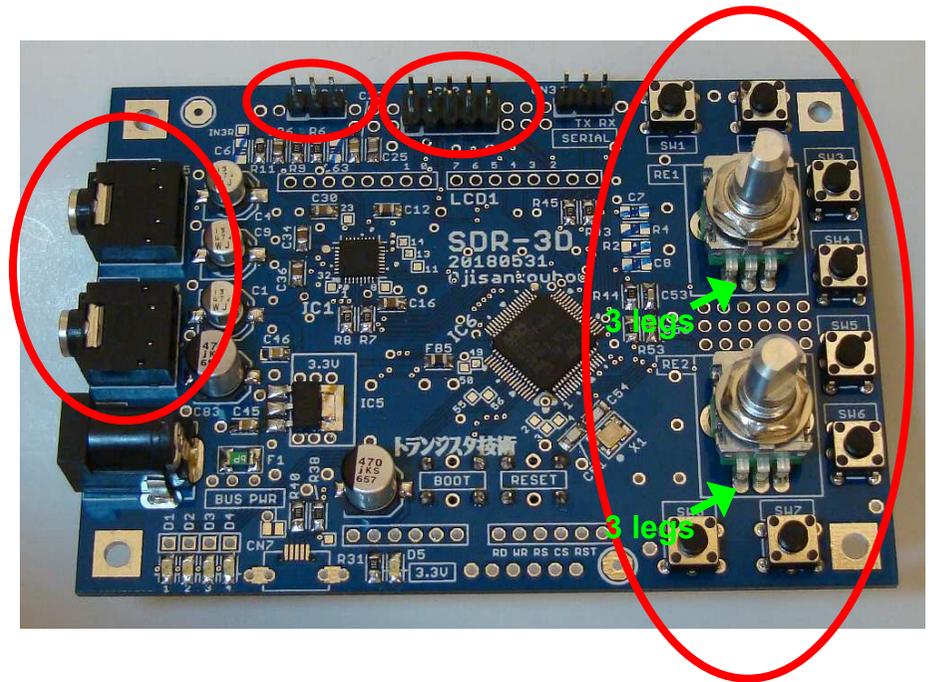
Cut out 3 pins of the 1 x 40 pin header included in the kit and use it.

- CN 2 2 x 5 pin header

Cut out the 2 x 40 pin header included in the kit by 2 x 5 pins. There is a hole for expansion at both ends of CN2. Please attach it to the silk.

- SW1 to SW8
- RE1, RE2

three legs are lower side.
Be especially careful that RE2 is not reversed.



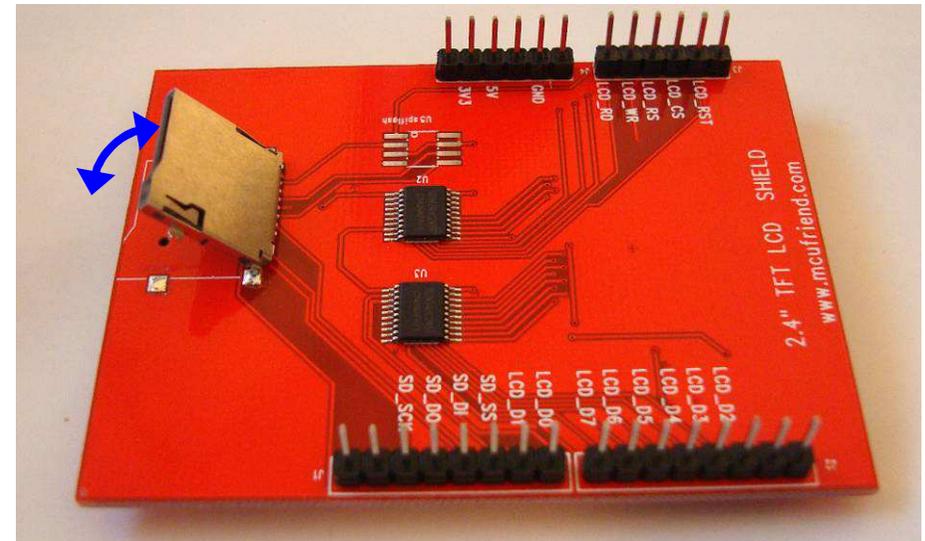
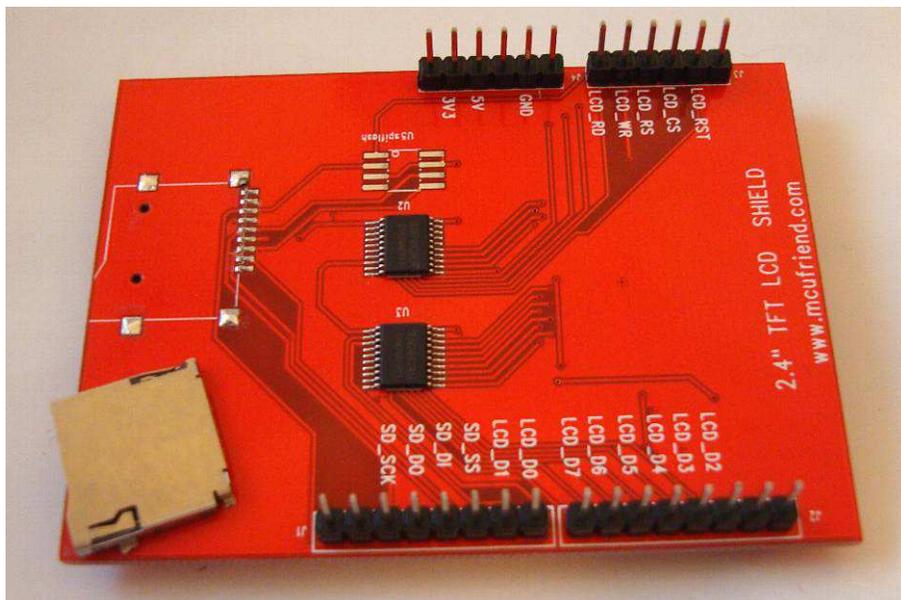
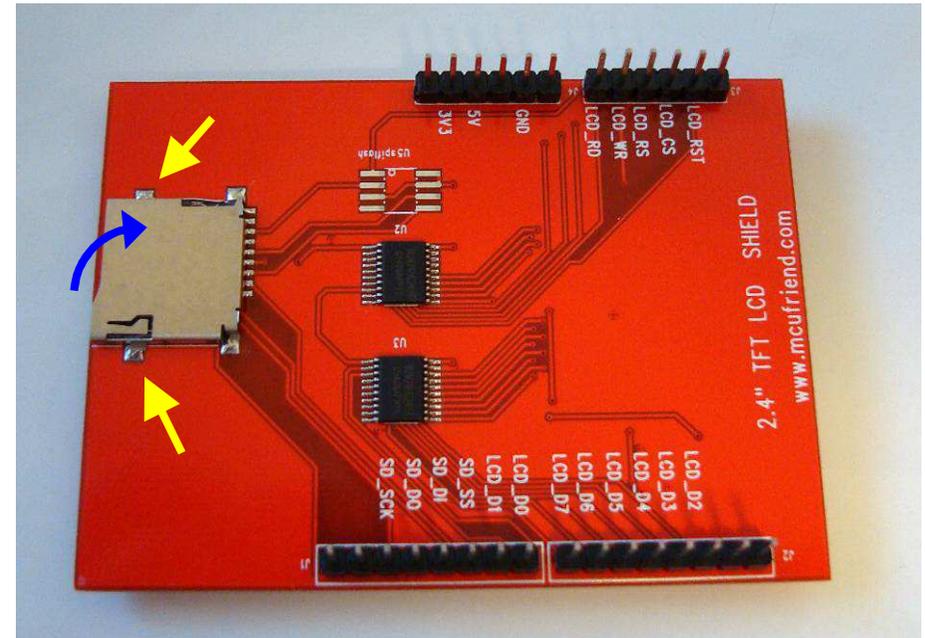
1 - 6 . SDR-3D LCD preparation

□ Removing the SD card connector on the LCD

Take the SD card connector off, because it hits the power connector.

While melting the soldering of the SD card connector (two yellow arrows) with the soldering iron, lift the the SD card with your fingers, move little by little.

When soldering on two places disappears, fold it up and down repeatedly, remove it.



1 - 6 . SDR-3D Soldering of connector for LCD

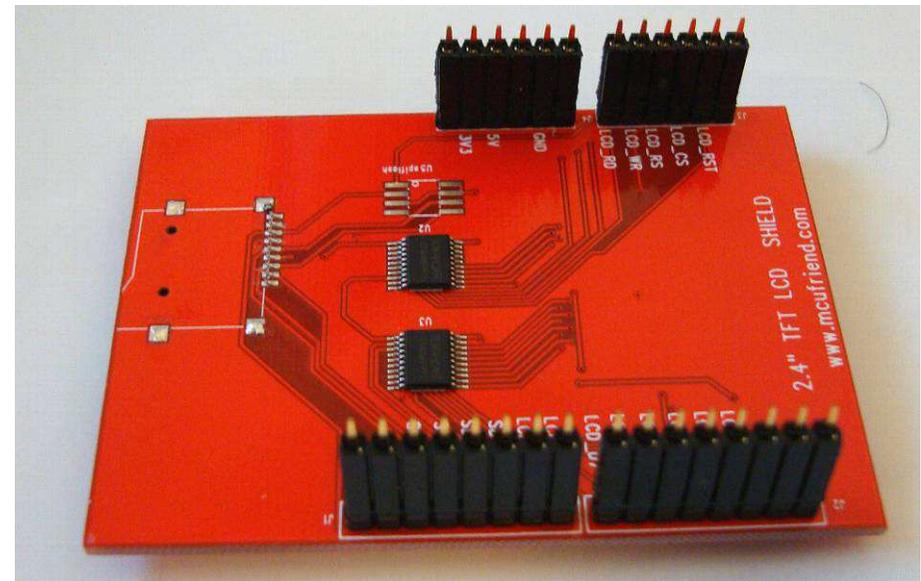
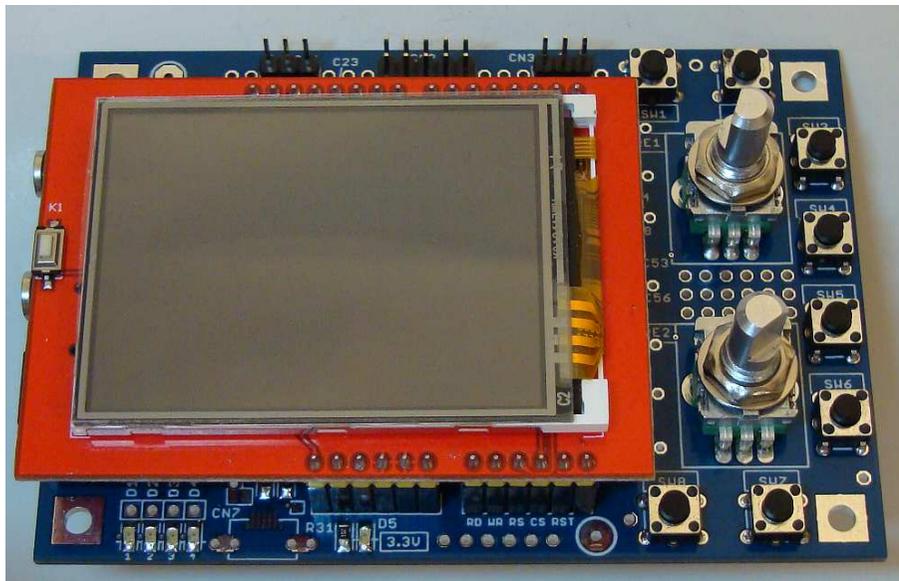
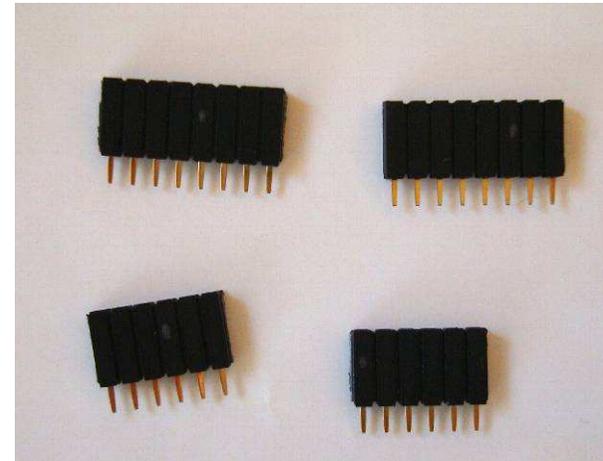
□ 4 connectors for LCD

Cut the 1 x 42 pin socket included in the kit by cutting 2 pieces for 8 pin and 2 piece for 6 pin.

Insert the socket into the LCD.

Insert it in the board as it is, use LCD as alignment jig.

Solder first at the four corners (one of each connector), correct the floating / tilting, etc., then solder the rest.



1 - 7 . SDR-3D Operation check

Connect the power supply (5 V)

- After the color bars (various color vertical bars) are at first, then it becomes the screen like right photo at around 5 seconds. Make sure that the spectrum display flickers and the reception level display changes.

The time and display depends on software version. The right picture is an example at the time of writing this manual.

At this point the current consumption is about 240 mA.

If it does not look like the one on the right photo, please look at the next page "Troubleshooting".

Next, Please confirm that,

- Turn RE 1 to change the frequency
- Turn RE 2 to change the volume

At this stage, since the SDR-3A board is not connected, timeout error frequently occurs, and the response is quite slow (about 2 seconds), but it is normal.

This completes the SDR-3D board. Proceed to assemble the SDR-3A board.



LED(D1)0.5sec blink

LED(D5)lit

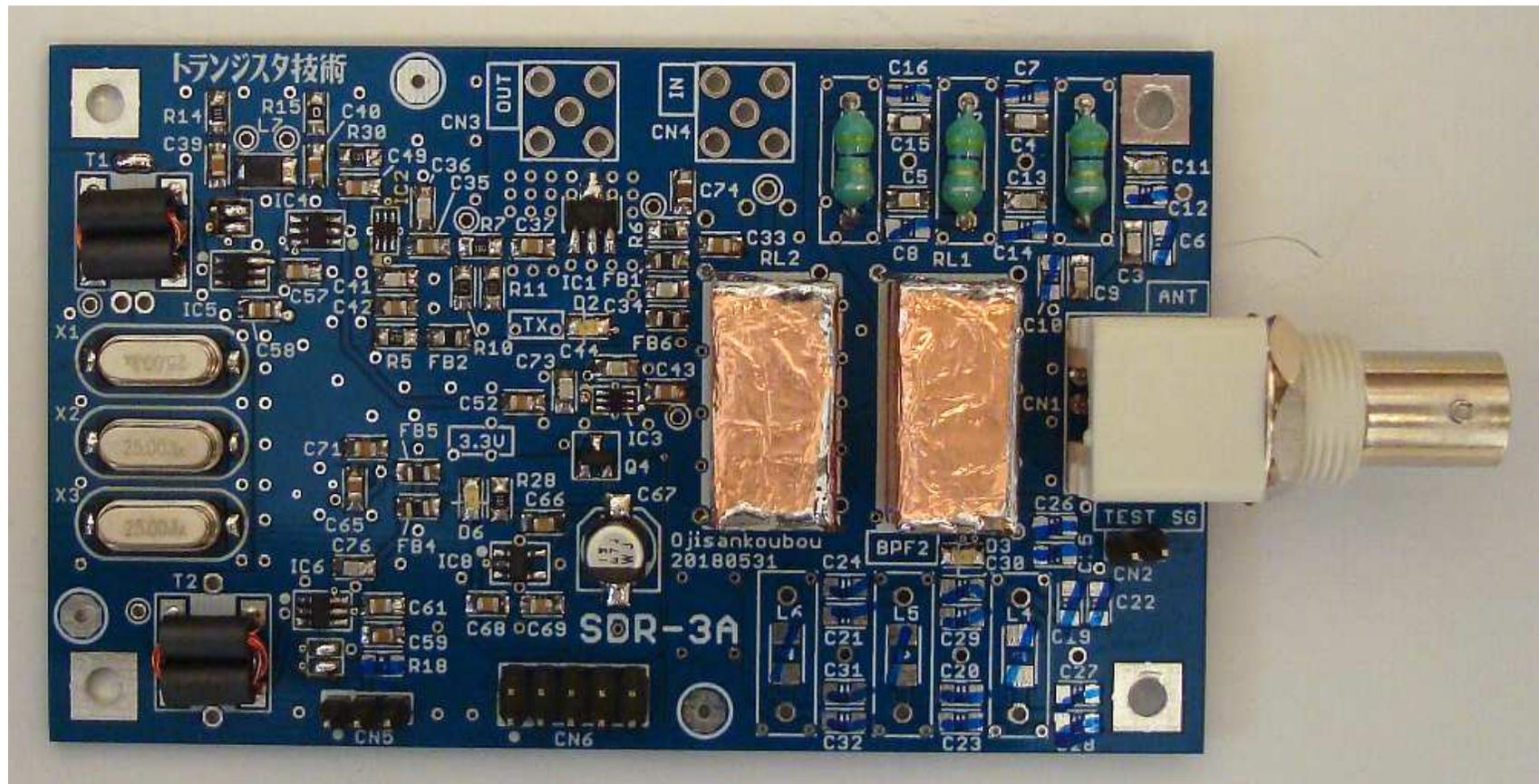
If the rotation direction of RE is wrong, refer to "RotEnc Dir" in "Operation Manual 4-1. Setting".

2. SDR-3A Assembly

Once you can assemble the SDR-3D board so that it operates normally, assemble the SDR-3A board (analog circuit) next.

It is not difficult to assemble the SDR-3A board if you follow the steps.
It is a quick way to assemble each steps reliably.

Photo of completed SDR-3A board



2 - 1 . SDR-3A Soldering the connector

First of all, solder only one pin and confirm from various angles whether parts are floating or not inclined.

If there is a float or tilt, correct soldering parts by pressing them with finger while soldering.

Solder the rest if there is no tilt.

It is good to temporarily fix parts with masking tape.

CN5 3 pin header

Cut the 3 x 1 pin header included with the kit and use it.

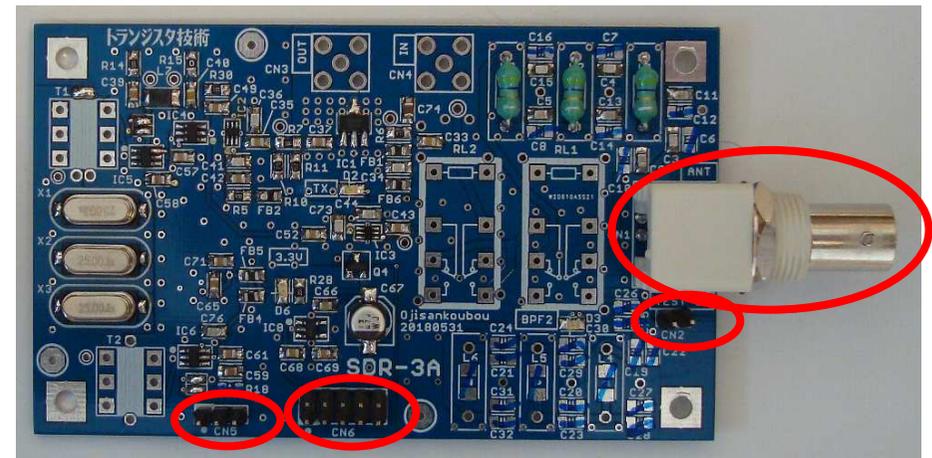
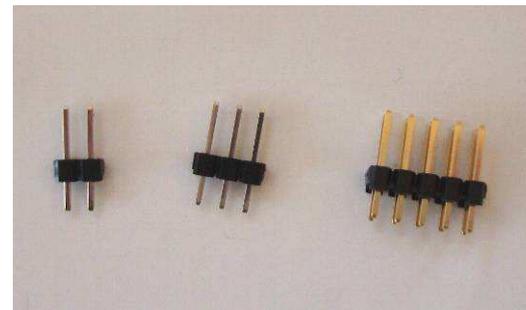
CN2 2 pin header

Cut 2 pins of the 1 x 40 pin header included in the kit and use it.

CN6 2 x 5 pin header

Cut out the 2 x 40 pin header included in the kit and use it for 2 x 5 pins.

CN1 BNC connector

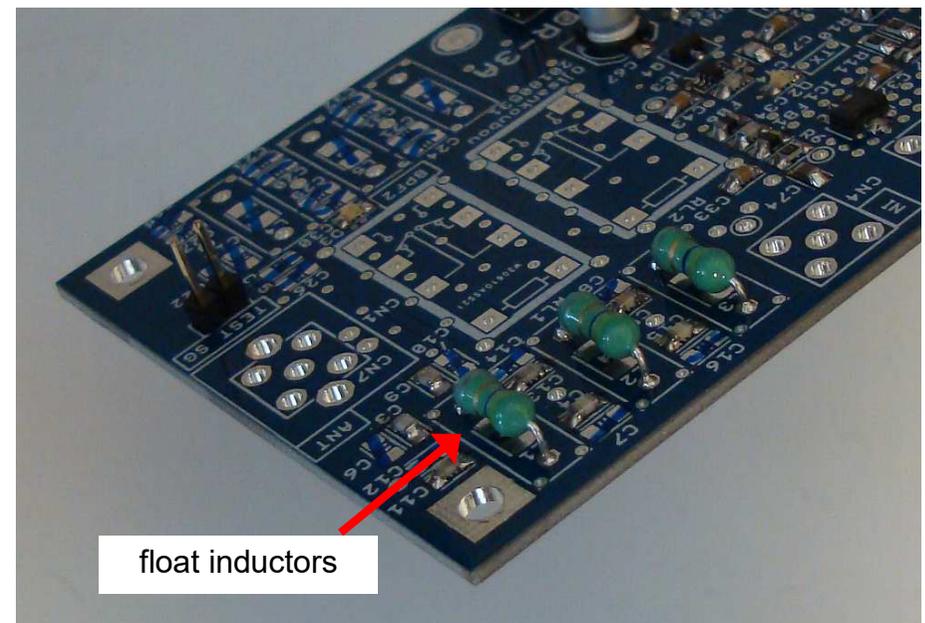
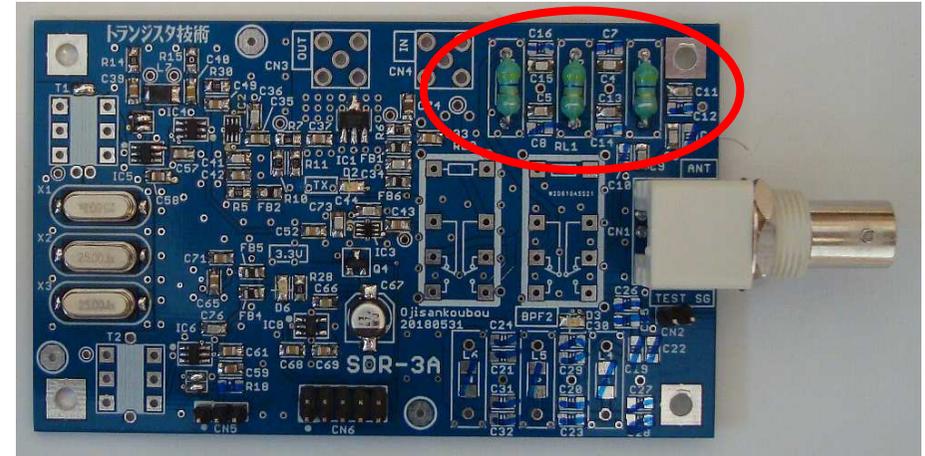


2 - 2 . SDR-3A Soldering the inductor

□ L1、L2、L3

Float the inductor by about 1 mm from the board.

After soldering, the leg of the inductor will be used for the connection of the relay shield later, so do not throw it away.



2 - 3 . SDR-3A Solder Jumper 1

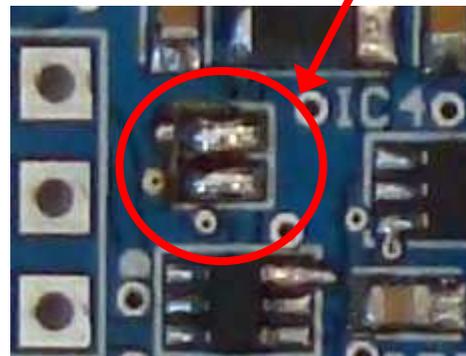
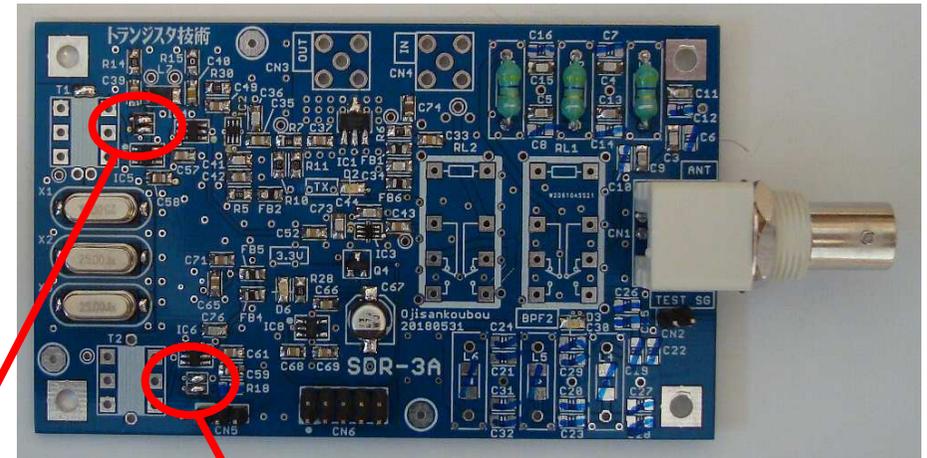
Switch Mixer operation mode Connect jumpers with solder.

- Top left of the SDR-3A board, near T1
- Bottom of SDR-3A board, near CN5

Both connect horizontally as shown in the photo.

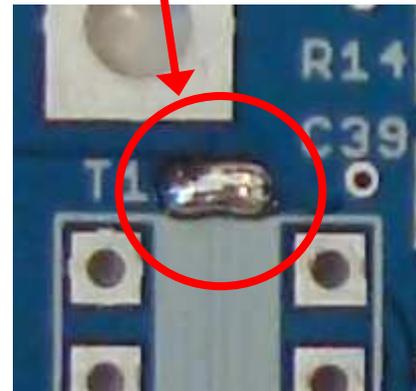
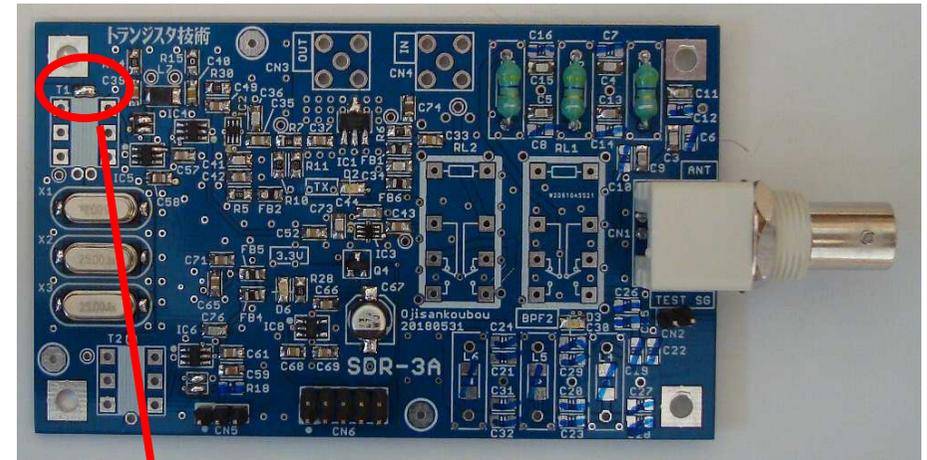
You can successfully flow solder a little more while heating the two lands to be connected with a soldering iron at the same time.

If you can not do it well, please solder using the UEW wire which you will use for the transformer.



2 - 3 . SDR-3A Solder Jumper 2

For connection to GND, connect two through holes with solder jumpers.



2 - 4 . SDR-3A Making Transformer 1

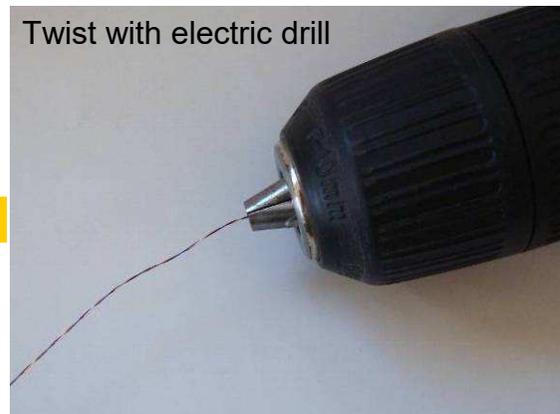
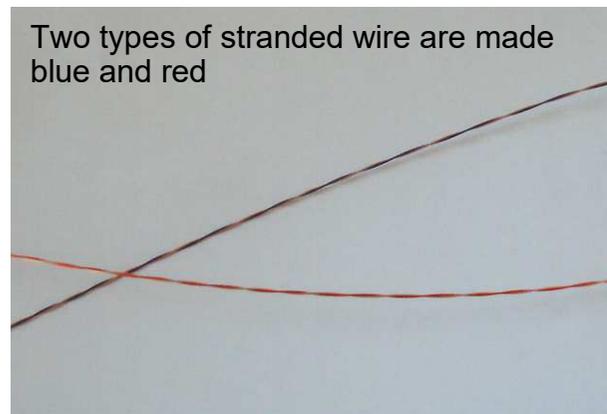
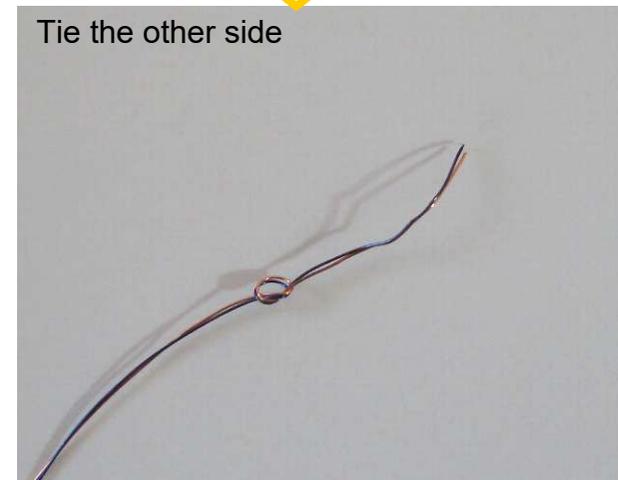
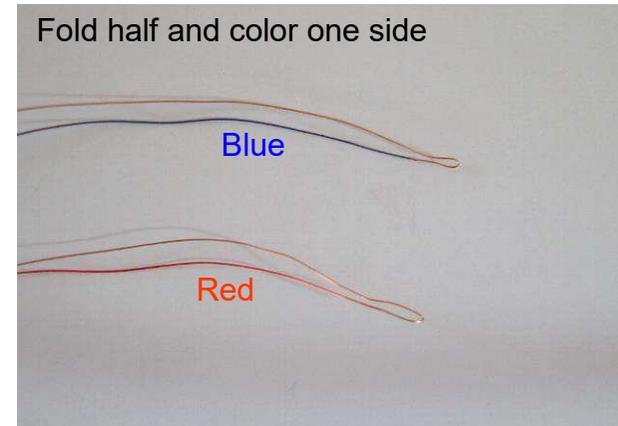
26

We will make a transformer for T1 and T2.

It may seem difficult if you are not used to it, but it is okay if you make it according to the procedure.

First, we make two kinds of stranded wires.

1. Cut the UEW 0.18 mm wire in half and fold each into half.
2. Put color with a magic pen on one side half of folded wire. You can easily color it by pulling the UEW wire while hold down the UEW wire with a magic pen on unnecessary paper. In the right photo, one side was painted blue and the other was painted red.
3. Tie in the same length on the opposite side.
4. Twist it to about 5 mm pitch using an electric drill.



2 - 4 . SDR-3A Making Transformer 2

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5. Winding 3 times on each 2 cores.

If you pass through the core once, it will wind once.
After winding one side, the other side winds from the opposite side.

6. After winding 3 times each, cut it to about 2 cm and loosen it.

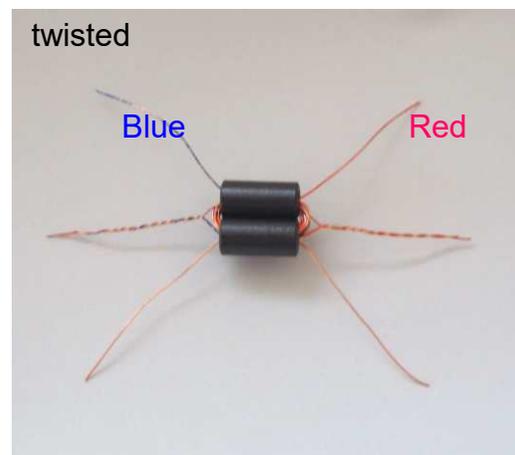
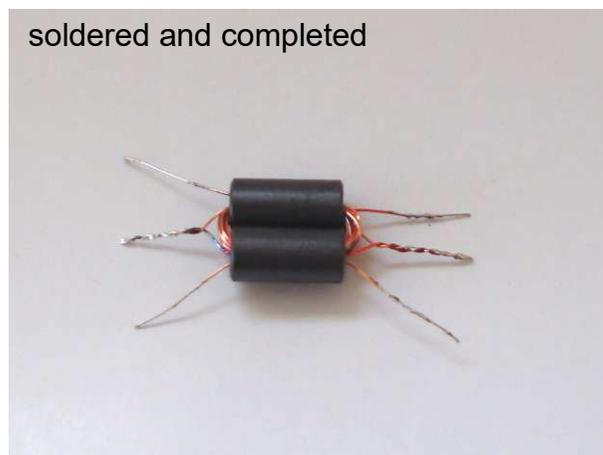
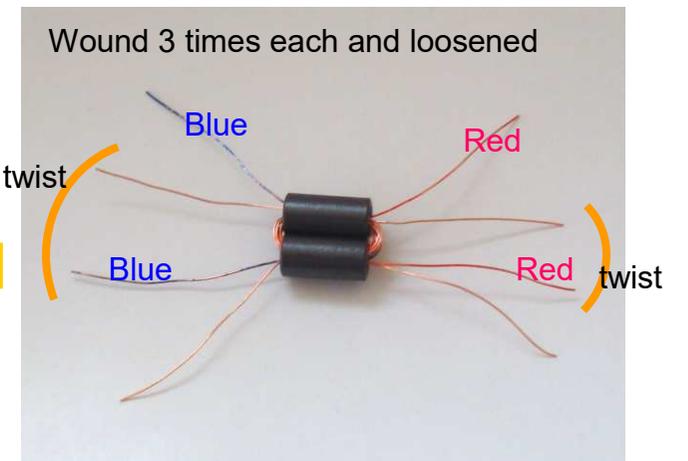
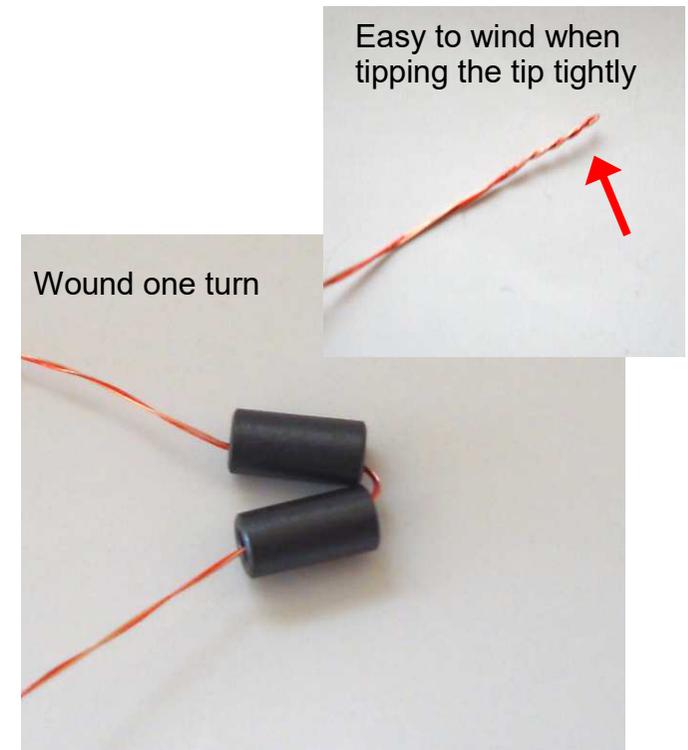
7. Twist the wire painted the blue at the beginning of winding and the unpainted wire at the end of winding.

Likewise twist the wire painted red at the beginning of winding and the wire not painted at the end of winding. The twisted part becomes the midpoint of the transformer.

8. Cut it to about 1 cm, and solder it about 8 mm with a soldering iron set to high temperature (about 400 degrees). Especially connect twisted (midpoint of transformer) securely.

If the UEW wire is heated from the incision, the film breaks and easy to solder.

9. make a same one again.



2 - 4 . SDR-3A Soldering the Transformer

□ T1、 T2

Solder the transformer made on the previous page.

Make the twisted midpoint in the middle.

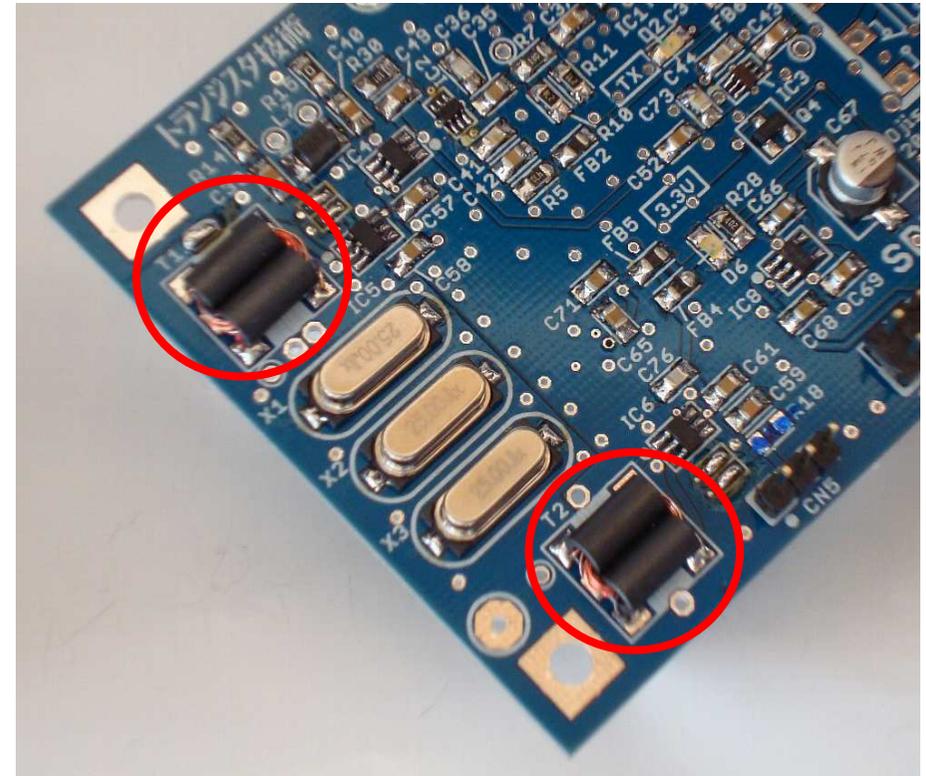
Since the primary side and the secondary side have the same number of turns, it is okay not to care which line color will be.

First, heat is applied from the soldered part of the UEW wire, and solder the UEW wire and the board land securely.

After soldering, cut off the line that jumps out on the back so as not to shortcircuit.

Characteristics of the transformer change greatly when changing the number of turns, turns ratio, core material and so on.

Since this kit can easily measure the characteristics of the Xtal Filter as described later, try various turns and cores to optimize frequency characteristics and attenuation.



2 - 5 . SDR-3A Soldering the Relay

□ RE1、RE2

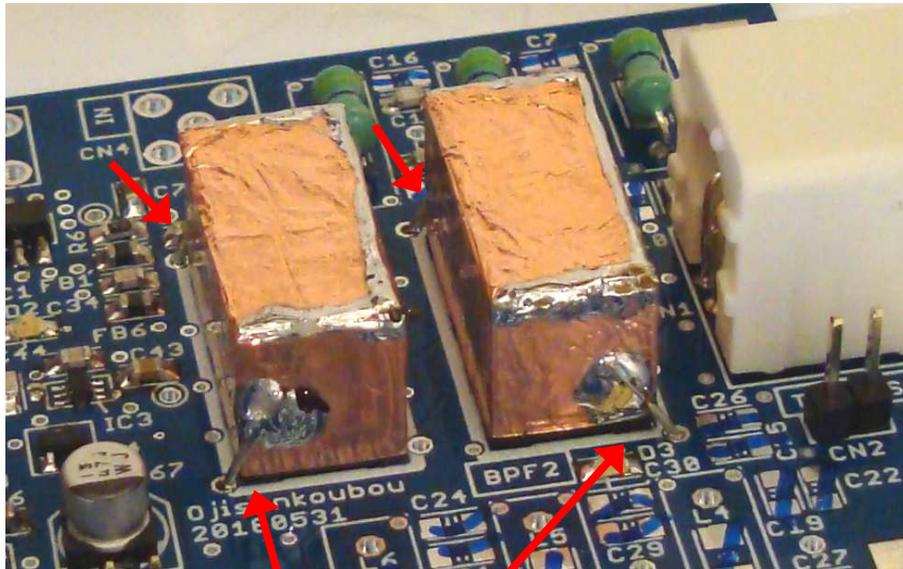
Wrap copper foil about 0.5 mm away from the bottom of the relay periphery.

Wrap it on top of the first winding (it becomes double).

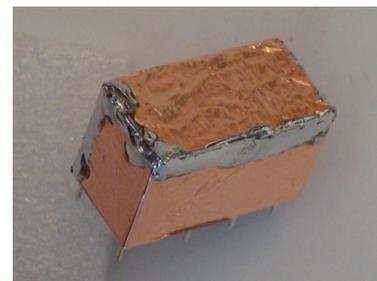
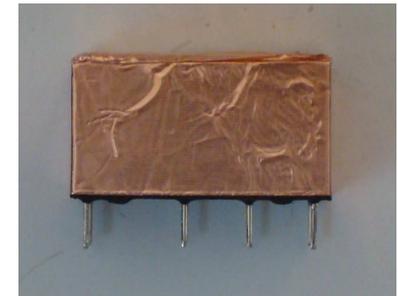
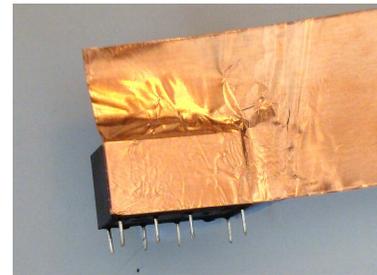
Cut the upper side in 4 directions with scissors, paste and paste.

Solder the joints.

After soldering the relay, connect the copper foil to GND with wires at some places. GND uses through holes around the relay.



Shield it with copper foil and connect it to GND at some places with wire (remainder of inductor's leg)

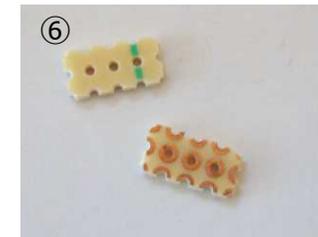
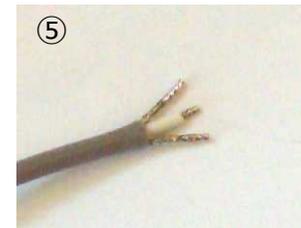
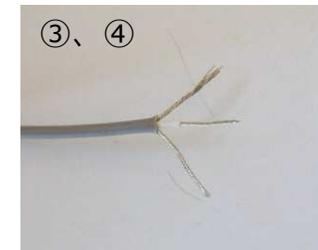
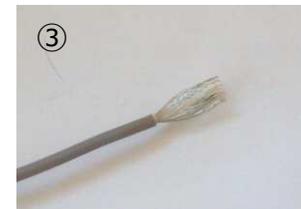
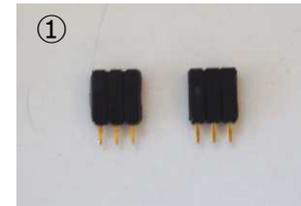
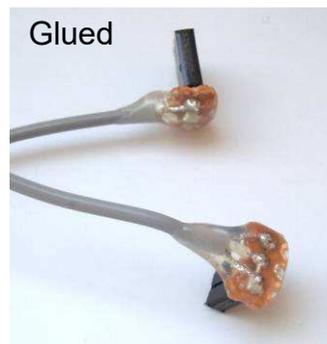


2 - 6 . SDR-3A Making Harness

Make a harness connecting the boards.

1. Cut out 1 pin of the 1 x 42 pin socket included in the kit and 2 pins of 3 pin.
2. Cut the shield wire to the same length as the 10 pin harness.
3. Strip the shield wire about 1 cm, twist the shield part into two equal parts.
4. Leave the core wire about 3 mm and peel off.
5. Solder and cut it to the extent that the core wire remains 1 mm.
6. If you have, prepare a 2.54 mm pitch universal board (not included in the kit) cut out for 3 holes.
7. Solder the universal board to the socket and solder the shield wire there.
If it does not solder it directly.

It is completed with this, but if you consolidate with glue gun (hot melt) etc., durability will increase.

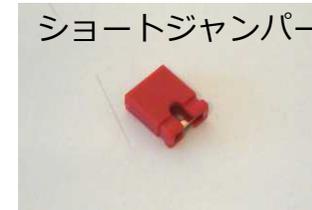


2 - 7 . SDR-3A Short jumper

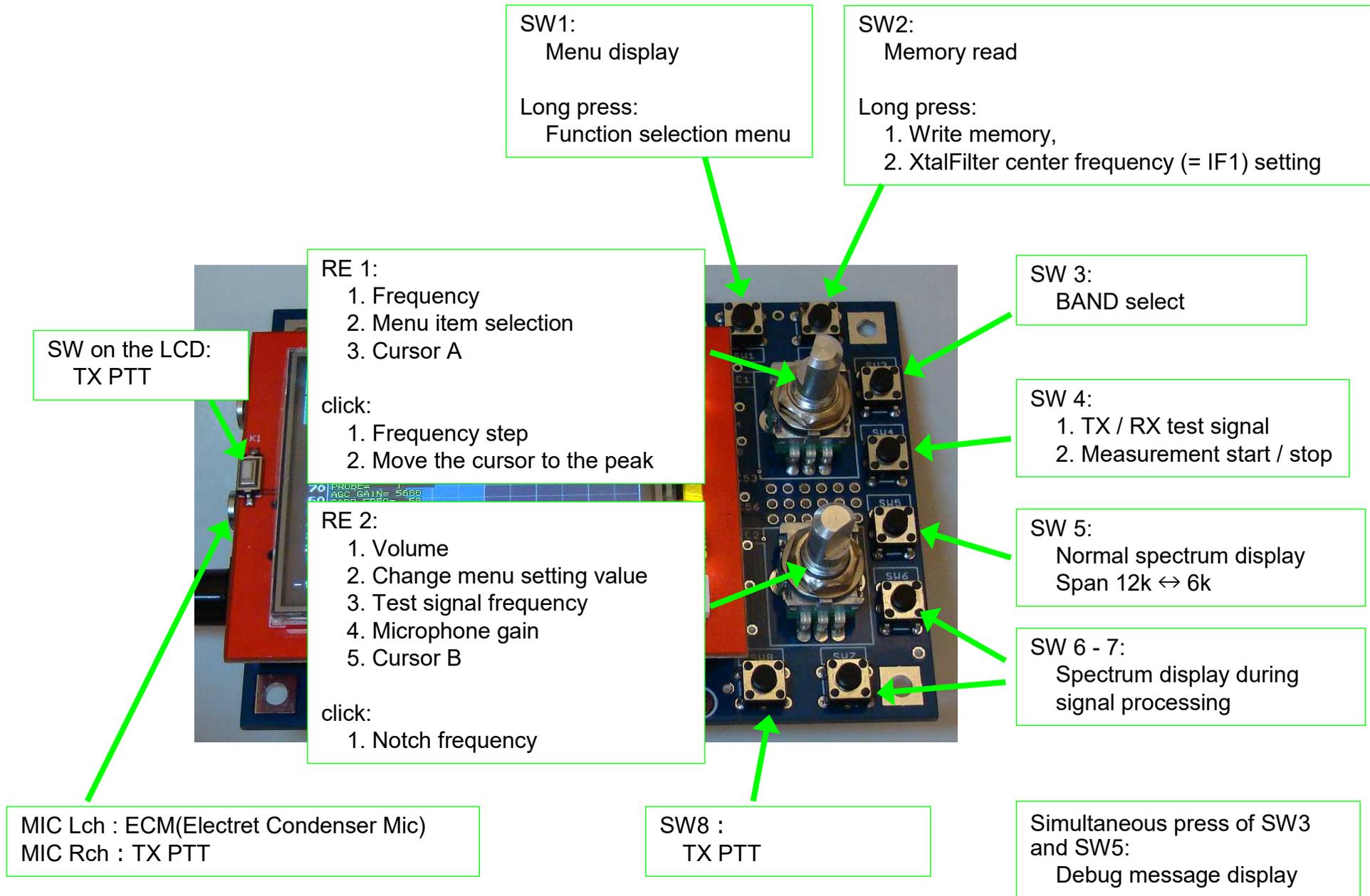
Make a short jumper which is used for putting the test signal.

If you have a short jumper like the picture on the right, you do not need to make it.

1. Cut the 1 x 42 pin socket included in the kit by 2 pins.
2. If you have, prepare a 2.54 mm pitch universal board (not included in the kit) with two holes.
3. Solder the universal board to the socket and short it with solder.
4. If there is no universal circuit board, bend the terminal of the socket and solder it.



3 - 1 . Operation outline



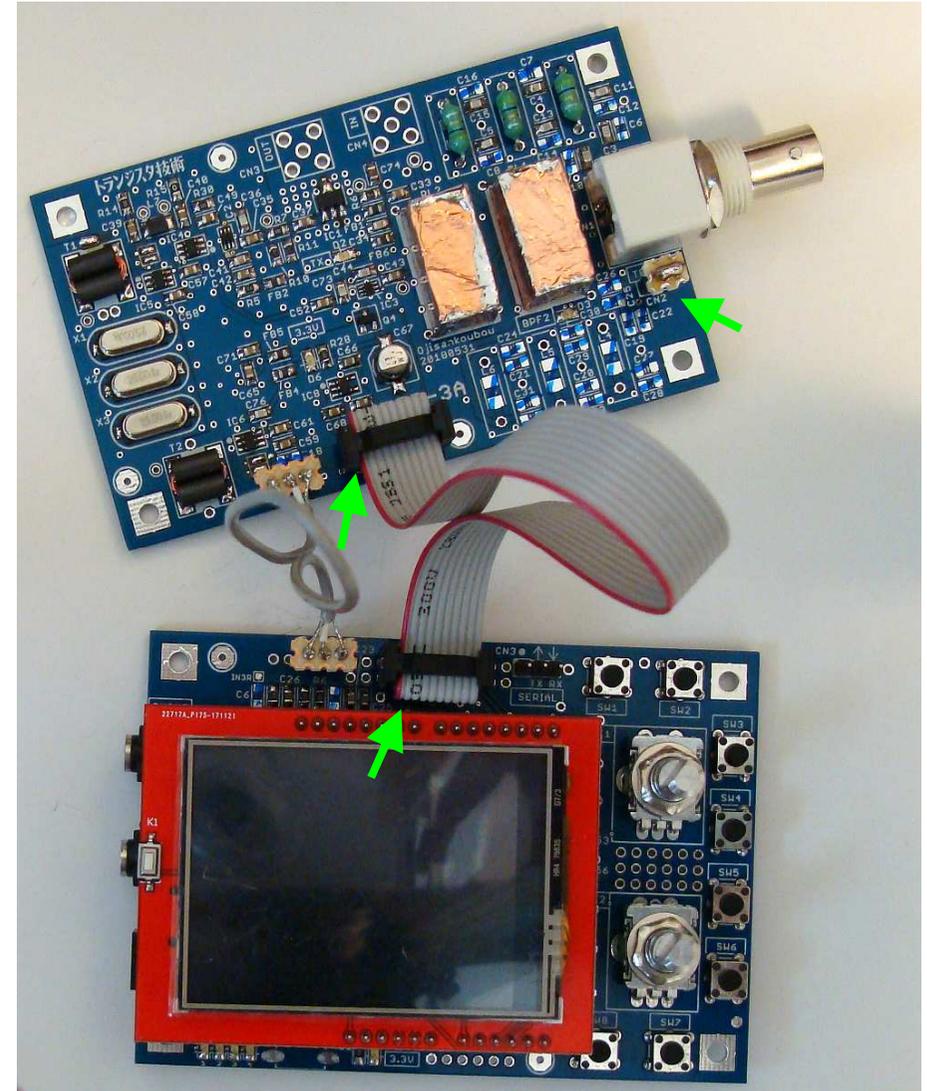
3 - 2 . Connect SDR-3D and SDR-3A 1

Connect the SDR-3D board to the SDR-3A board and test it.

As shown in the photo, connect the two boards with 10p harness, the 3p shield harness.

The 10p harness has polarity. Pin of harness so that it becomes white circle mark of PCB silk.

CN2 (TEST SG) is short-circuited with a short jumper.



3 - 2 . Connect SDR-3D and SDR-3A 2

When you turn on the power supply (+ 5V), it becomes a transceiver screen.

At this point the current consumption is about 300 mA.
After this, it increases to about 400 mA by TX and relay operation, so when using CVCC power supply, set the current limit at about 500 mA.

- D5 on SDR-3D board lit
- D1 on the SDR-3D board blinks in 0.5 seconds
- D6 on the SDR-3A board is lit
- LCD spectrum display and signal level change

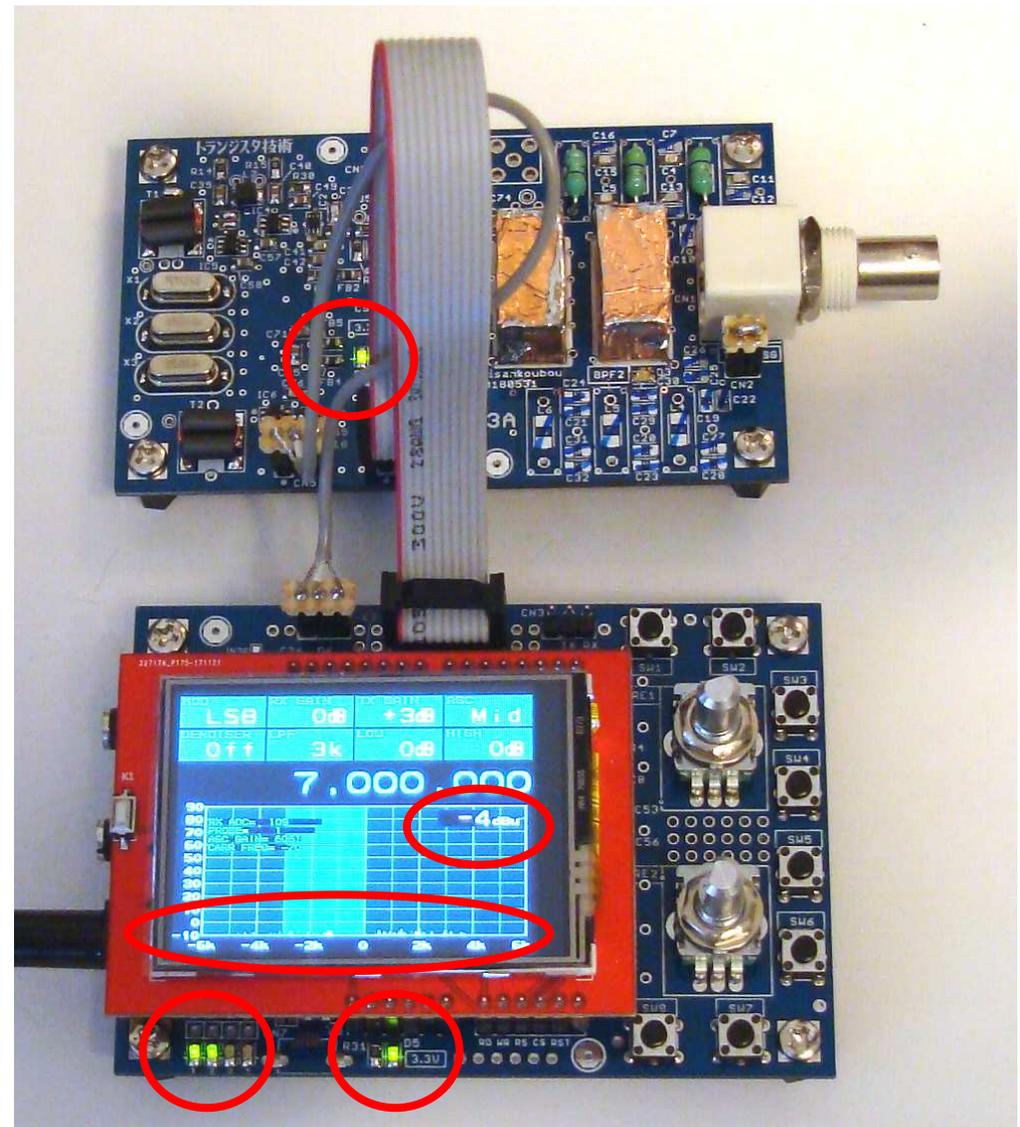
Please confirm items above.

When there is an abnormality,

Please make sure that 10p harness is not reversed.

Please turn on the power without inserting the harness and check again whether D5, D1 of the SDR-3D board normally turns on.

Please check soldering whether SDR-3A board is short-circuited somewhere.



3 - 3 . Operation test SW

Confirm that SW works properly.

- Press SW1 to enter the menu screen, press again to return to the original.
- Long press SW1 to display the function selection menu screen. Select "SSB Tranceiver" and press SW1 to return.
- Pressing SW3 activates RL1 (BPF switching), and D3 (BAND) lights up.
- Press SW4 to turn on the RX test signal.

Make sure that a large signal appears at the center of the screen.
Press SW4 again to turn off.

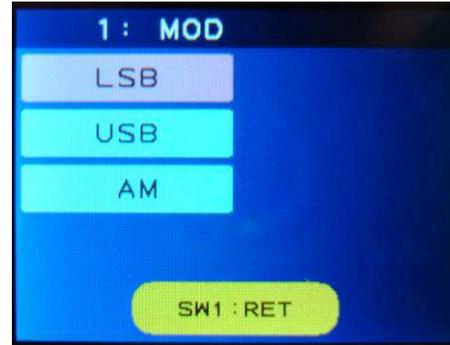
- Pressing SW8 activates RL2 (TX / RX switch), and D2 (TX) lights up.

"TX" indication appears on the screen.

- When you push RE1, the pop-up of "F. Step" will come out, it disappears after a while.

You can change the frequency step by turning RE1 while the popup is on.

menu screen



function selection menu screen



large signal appears at the center of the screen



"TX" indication on the screen



Signal strength changes due to variations in the receiving circuit.

If the signal level is extremely low, please check whether CN2 (TEST SG) is shorted with a short jumper and BPF1 is selected. If that is not enough, go to "3-5 BPF Troubleshooting".

3 - 4 . Operation test Rotary Encoder

Confirm that the rotary encoder works.

- Turn RE1 to check if the frequency changes smoothly
- Turn RE2 to check if the volume changes
- When you push RE1, the pop-up of "F. Step" will come out, it disappears after a while.

You can change the frequency step by turning RE1 while the popup is on.

By connecting the SDR-3A board, the I2C communication error should disappear and the operation should be smooth.

tranceiver screen



turning RE1



"F. Step" pop-up



3 - 5 . Operation test BPF

Check the frequency characteristics of the BPF between the ANT and the transmit / receive circuit. You can also check that the receiving circuit operates normally by looking at the response of the passband.

In this kit, since BPF1 contains BPF of 7 MHz, measure the characteristics of BPF1.

1. Press and hold SW1 to display "Function selection menu".
2. Select "2.BPF" with RE1.
3. Press SW1 to enter BPF measurement screen.
4. Press SW4 to start measurement.
5. Cursor A moves with RE1 and cursor B moves with RE2.

Cursor A displays the measured value at the cursor and cursor B shows the difference from cursor A.

Pressing RE1, RE2 moves each cursor to the peak of the measured value.

6. Long Press SW1 to return to the "function selection menu".

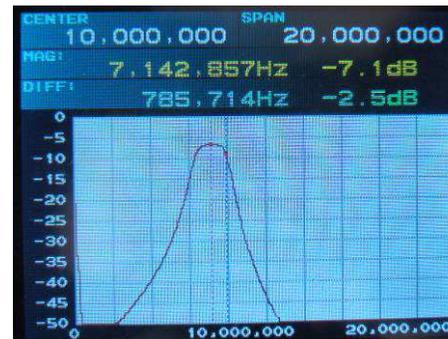
Function selection menu



BPF measurement screen



move cursor



Although the absolute value changes due to variations in the receiving circuit, it is normal if it has a waveform similar to the above frequency characteristics.

If it is wrong, please check whether BPF1 is selected and short jumper is inserted in CN2.

3 - 5 . Operation test BPF Troubleshooting 1

38

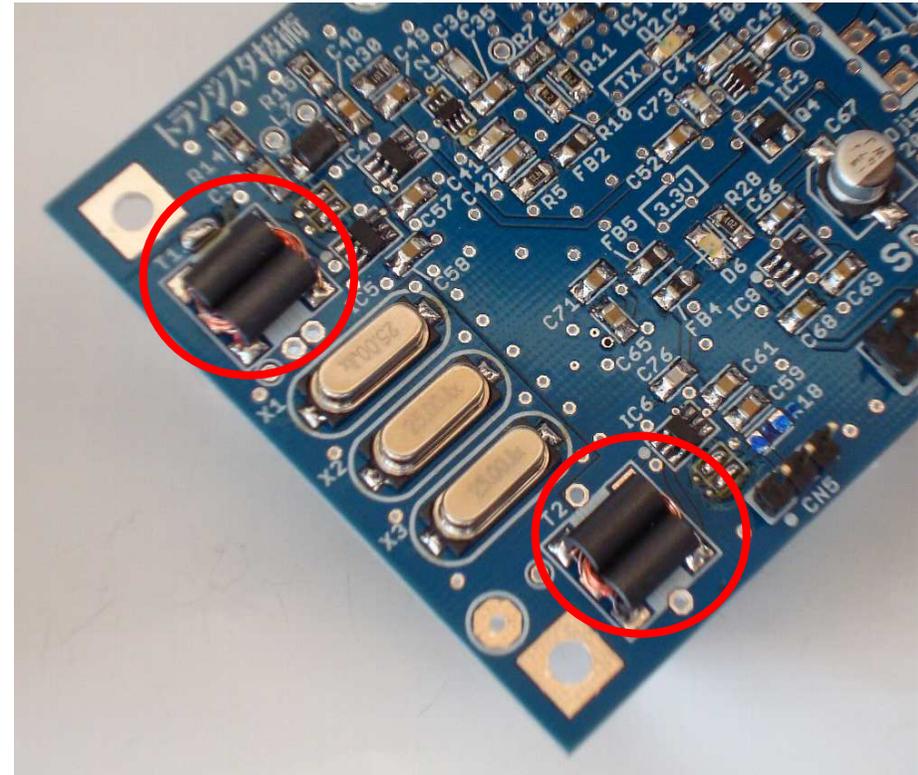
The fact that the BPF frequency characteristics can not be measured properly means that it is not functioning properly as a receiver.

The cause is between IC 7 (PLL) on the SDR-3A board and IC 1 (AUDIO CODEC) on the SDR-3D board.

The most likely cause is transformers.

Please check the soldering of the transformer T1, T2 first.
Please check the soldering of especially the middle point of the transformer (where we twisted the two wires) carefully.

If there seems to be no problem, please follow the signal on the next page procedure in order to find the defective part.

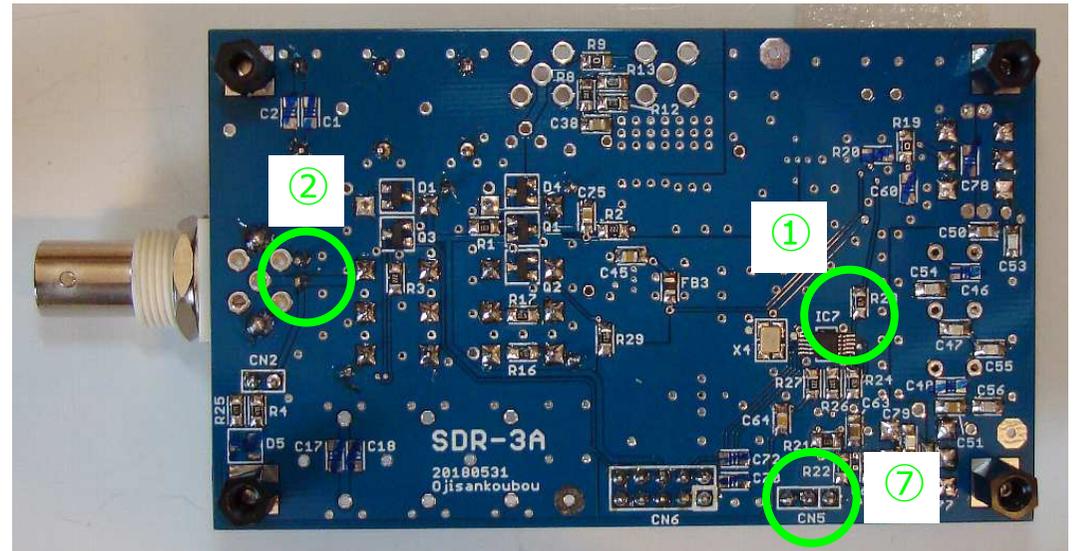


Please check where the signal is lost by following procedure. Oscilloscope is necessary for this confirmation.

1. Make it a transceiver screen
2. Press SW4 to enter RX TEST signal mode.
If it is normal you can receive the signal here.

Below, we will check the signal with the oscilloscope in order.

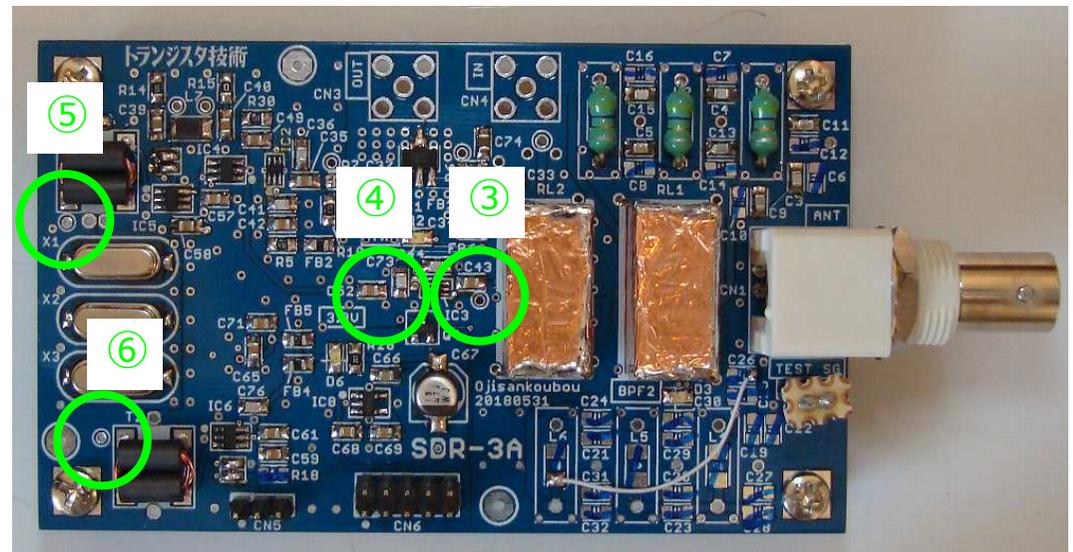
1. SDR-3A board IC7 10 pin (R26), 7MHz 3.3Vpp square wave.
2. 7 MHz 20mVpp square wave at CN7 (BNC)
3. 7 MHz 20mVpp sine wave at RL2 and C43 connection point



Since other carrier signals etc. are observed together from hereafter, you can press SW4 to turn on / off the RX TEST signal mode and see if the signal level changes.

4. IC3 3 pin (C52) with 7MHz 100mVpp
5. 25MHz 150mVpp on X1 side of T1
6. 25MHz 150mVpp on X3 side of T2
7. CN5 2 pin with 12kHz 600mVpp

When you know where the signal goes out, check the circuit between the point where the signal was on and the point where it ceased to be more detailed with an oscilloscope and look for the defective part.



3 - 6 . Operation test Xtal Filter

Check the frequency characteristics of Xtal Filter.

The center frequency of Xtal Filter is IF1 (intermediate frequency). This Xtal Filter is used to remove carrier leakage and images generated when frequency conversion from IF2 of 12 kHz to IF1(around 25MHz).

1. Press and hold SW1 to display "Function selection menu".
2. Select "3. Xtal Filter" with RE1.
3. Press SW1 to display the XtalFilter measurement screen.
4. Press SW4 to start measurement.
5. Cursor A moves with RE1 and cursor B moves with RE2.

Cursor A displays the measured value at the cursor and cursor B shows the difference from cursor A.

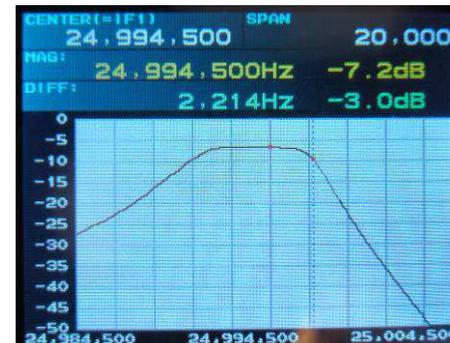
Pressing RE1, RE2 moves the respective cursor to the peak.

6. Long Press SW1 to return to the "function selection menu".

Function selection menu



XtalFilter measurement screen



Absolute value changes due to variations in the circuit, but it is OK if the measurement center frequency is in the pass band of XtalFilter.

For the adjustment method of the center frequency, refer to the operation manual.

3 - 6 . Operation test Xtal Filter Troubleshooting

When the Xtal Filter frequency characteristic has large undulation or the level of the passband is low,

Confirm soldering of the transformer T1, T2.

Confirm soldering between X1 and X3.

If that is not enough, please try to remake the transformer again.

3 - 7 . Operation test Receiver

Connect the amplifier-equipped speaker or earphone to the CN5 (PHONE) terminal.

Remove the short jumper on CN 2.

If the quality of the power supply is bad, noise will increase in the spectrum display. Please change to a power supply with low noise.

1. Connect the antenna to the CN7 (BNC) ANT terminal.

Broadcast can not be received because BPF1 is 7 MHz.
To receive the broadcast, connect the input and output of BPF2 to make it signal-through, and select BPF2 with SW3 .

2. Turn RE1 to change the receive frequency, press RE1 to change step frequency.

3. Change the volume with RE2.

4. Press SW1 to go to "Menu" and change the setting.

Please change settings and receive broadcasts and various signals.

If it operates so far, it is completed in 80%.

Listen to radio broadcasts, please relax and have a coffee break.

receiver noise



When the noise is extremely large or not flat, the power supply is suspicious.

To receive AM radio broadcasting, use BPF2 as through by connecting by wire.
Please refer to "4-1. Make BPF 2 Thru".

3-8. Operation test transmission

Oscilloscope is necessary for transmission test.
Absolute value can not be measured when you do not have it, but it is OK even if you connect the signal to the receiver.

Connect to CN7 (BNC) with 50 Ω dummy load, or connect ATT (about 40 dB) via receiver .

Remove the short jumper on CN2.

1. Press SW8 (PTT) on the transceiver screen to TX.
2. Press SW4 to enter the TX TEST signal mode. Pressing SW4 repeatedly changes the test signal as follows.
 1. Single tone, AF1 frequency with RE2
 2. two tone, AF2 frequency with RE2
 3. tone burst, AF1 frequency with RE2Test signal OFF

Since the spectrum received by looping back the transmission signal is displayed on the screen, you can see what type of test signal is being output.

- When single tone, confirm that the signal of 7MHz approximately 1Vpp appears on the CN7 (BNC) output.
- When two tone, confirm that a waveform like the right photo of about 1Vpp appears.

transmission state



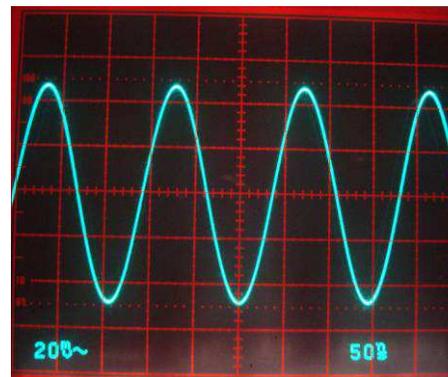
single tone test signal



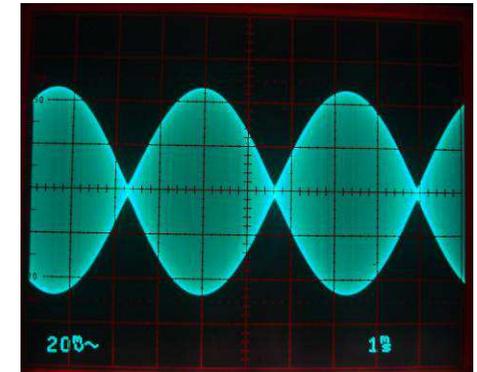
two tone test signal



single tone transmission



two tone transmission



3 - 8 . Operation test transmission troubleshooting

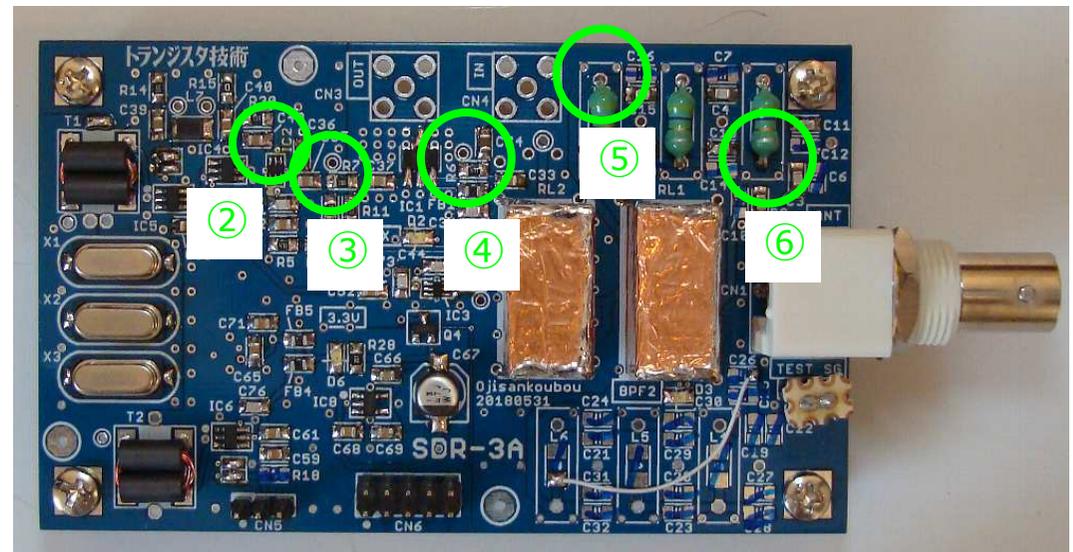
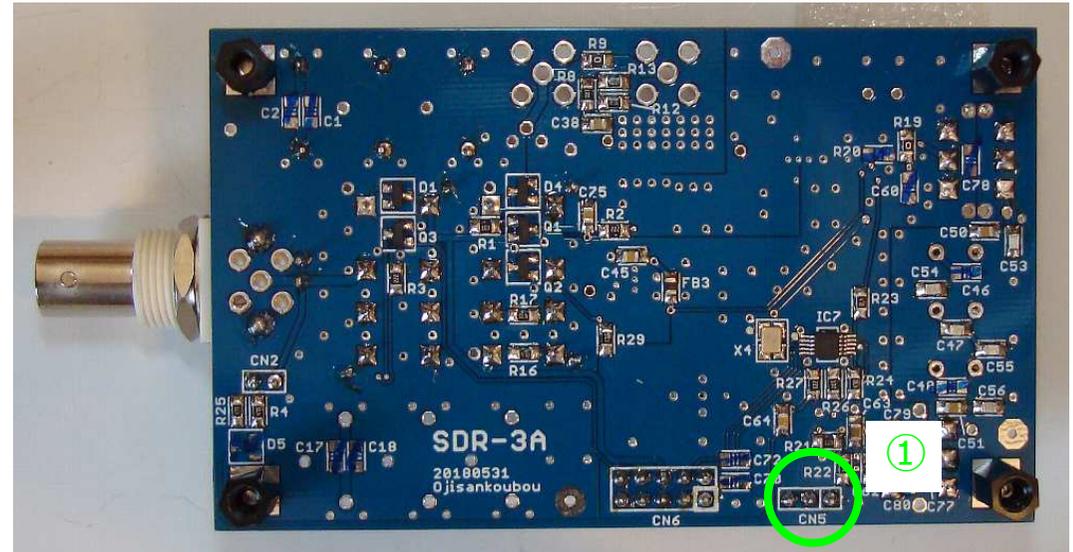
Please check where the signal is lost by following procedure. Oscilloscope is necessary for this confirmation.

1. Make it a transceiver screen
2. Press SW8 to enter transmit mode.
3. Press SW4 to enter TX TEST signal mode.

Below, we will check the signal with the oscilloscope in order.

1. SDR-3A board CN5 2pin with 11kHz 100mVpp
2. IC2 6pin (C36) with 7MHz 40mVpp
3. 7 MHz at C35 and R7 connection point 280mVpp
4. 7 MHz 1.8 Vpp at C38 and R6 connection point
5. 7 MHz 1.2 Vpp at L3 and C15 connection point
6. 7 MHz 1.1 Vpp at the connection point of L1 and C3

When you know where the signal goes out, check the circuit between the point where the signal was on and the point where it ceased to be more detailed with an oscilloscope and look for the defective part.



3 - 9 . microphone、 PTT SW

Prepare the microphone and PTT SW to be used for transmission (not included in the kit).

- Condenser microphone (ECM 2 terminal type)
- PTT SW
- Stereo mini plug (ϕ 3.5 mm)
- 2-core shielded wire

So far we have used SW8 as a PTT SW, but this is not easy to use, so prepare it separately with a microphone.

Lch of CN4 (MIC) is microphone input and Rch is PTT SW.

Connect ECM condenser microphone between Lch and GND. There is a microphone bias circuit on the SDR-3D board, please connect directly.

Connect PTT SW between Rch and GND.

PTT SW operation (toggle, momentary) can be changed by "Setting". Please refer to "Operation Manual 4-1. Setting".

4 - 1 . BPF2 Design

You can add BPF of your favorite frequency in BPF2.
You can select BPF with SW3.
BPF selection information is also recorded in ch memory.

Although there are many design method of BPF, you can find them in web.

The following is a method of frequency conversion of BPF of 7 MHz used for BPF1.

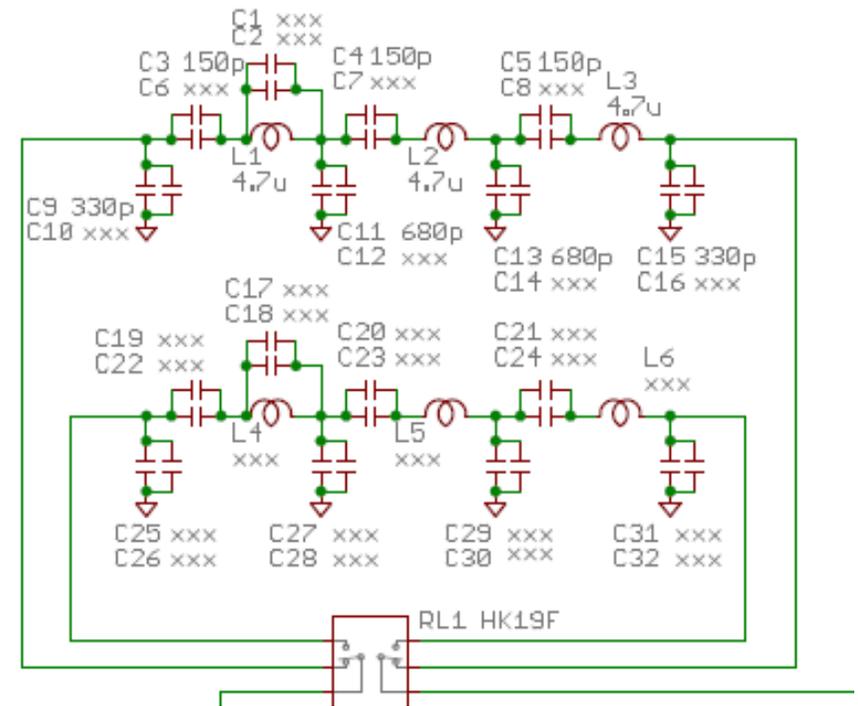
■ Designed by frequency conversion

For example, when you want BPF of 14 MHz,
Frequency ratio = 7 MHz / 14 MHz = 0.5
We multiply all L, C by 0.5.

L 4, L 5, L 6	= 4.7 u H * 0.5 = 2.35 u H	→ 2.2 u H
C 25, C 31	= 330 p * 0.5 = 165 pF	→ 150 pF
C27, C29	= 680 pF * 0.5 = 340 pF	→ 330 pF
C19, C20, C21	= 150 pF * 0.5 = 75 pF	→ 68 pF

In this state it is an odd value, change it to the value actually used, simulate with LTspice etc and confirm the characteristics.

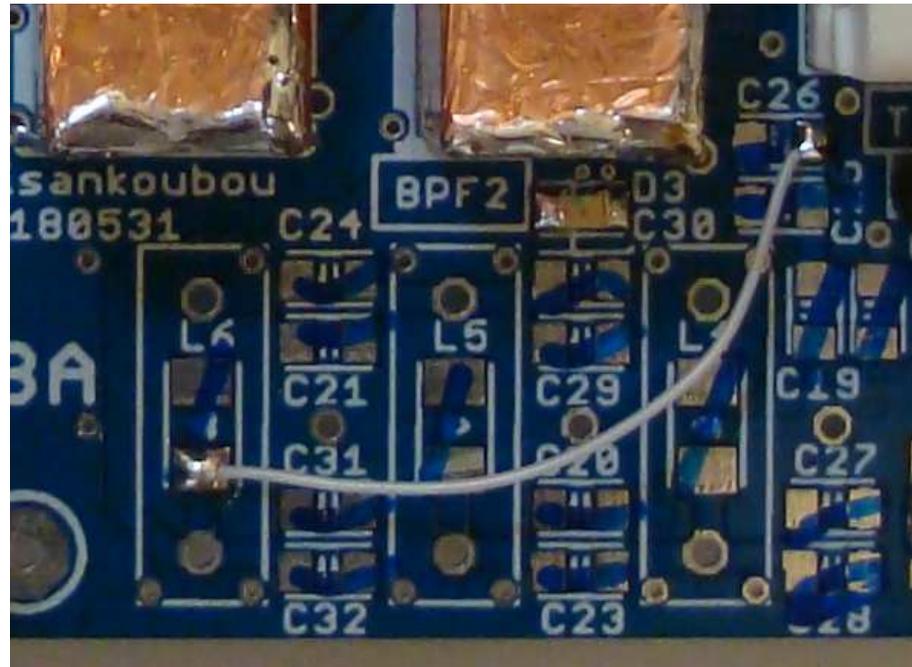
After attaching parts to BPF2, "BPF measurement" is performed to check whether desired characteristics are obtained.



4 - 1 . BPF2 through filter

If you put a "signal-through" filter in BPF2, you can receive AM broadcasting etc.

Connect the input and output of BPF 2 with wire as shown in the picture.



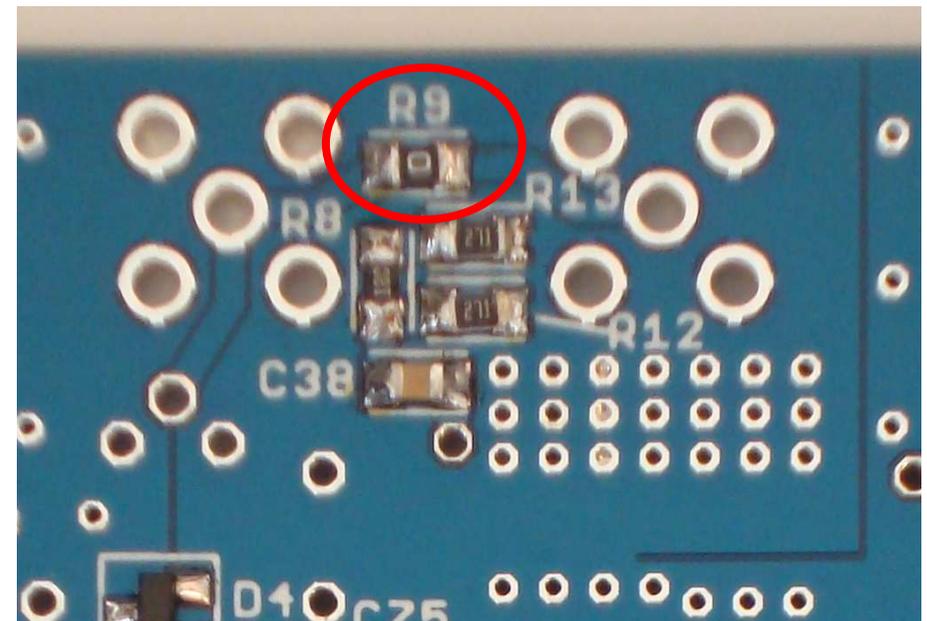
4 - 2 . Power Amplifier

Power amplifier can be added between CN3 and CN4 of SDR-3A board.

The maximum output power value is limited by relays, parts of BPF, etc, but it is not known exactly how much W can withstand (up to several W?). Please add power amplifier at your own risk.

Even if something breaks or ignites at worst, please be aware that you will be responsible under your own responsibility.

1. Remove R9 (0 Ω).
 2. Change the BPF to parts with large current capacity and withstand voltage depending on power.
 - Make the inductor wound around a toroidal core etc.
 - Change the capacitor to parallel, or to discrete parts with large current capacity and withstand voltage.
 3. Add an SMA connector (female) to CN3, CN4.
 4. Connect CN3, CN4, and power amplifier with SMA coaxial cable
 - Set CN3 (OUT) to power amplifier input
 - Connect the output of the power amplifier to CN4 (IN).
 5. Test by connecting a dummy load
- Check whether there is no smoke, no fire or malfunction.



4 - 3 . Rotary Encoder and SW's

In order to put rotary encoder and SW's on a remote place (such as the front panel) without using the rotary encoder and SW's on the board, make the same circuit (right figure) as the circuit of the SDR-3D board externally and connect it to the SDR-3D board.

PB0, PB1, GND is at RE2 (red circle in the photo below), so connect here to the rotary encoder and SW's which was made externally with a 3 pin harness by placing pin headers here.

Do not mount the rotary encoder on the SDR-3D board when placing the rotary encoder externally.

