

DX FT8 – FT8 DIGITAL TRANSCEIVER HARDWARE

BUILD and CONTROLS, INPUTS/OUTPUTS

OPERATION GUIDE



DX FT8 is a FT8 Digital mode capable HF QRPp GUI (Graphical User Interface) based multiband Transceiver.

Main aim of DX FT8 TRX Project is to create a highly portable self-contained FT8 GUI Transceiver. Self-contained aim is to create User interface plus Multiband transceiver in the same unit. This creates an advantage of carrying one GUI based TRX unit and no longer need to carry a PC or a laptop or tablet for GUI interface operation for FT8 with a classic transceiver.

This approach is quite appealing for smaller and lighter setups for backpacking for SOTA or POTA activations or as a travel transceiver with FT8.

Here are some highlights on DX FT8 Specifications:

- DX FT8 Transceiver GUI (Graphical User Interface) and processing power comes from ST Micro STM32F746 DISCO Evaluation board. This is a ARM CORTEX based evaluation board for STM32F746 microcontrollers with below outlined specifications:
- STM32F746NGH6 Arm® Cortex® core-based microcontroller with 1 Mbyte of Flash memory and 340 Kbytes of RAM, in BGA216 package
- 4.3” RGB 480×272 color LCD-TFT with capacitive touch screen
- 128-Mbit Quad-SPI Flash memory
- DX FT8 Transceiver RF Board plugs into STM32F746 DISCO evaluation board to form the DX FT8 transceiver.
- DX FT8 Transceiver operates on 5 HF bands. These bands are:
 - 1 – 20m (14.074 MHz)
 - 2- 17m (18.100 MHz)
 - 3- 15m (21.074 MHz)
 - 4- 12m (24.915 MHz)
 - 5- 10m (28.074 MHz)

DX FT8 Transceiver has two RF Power Output Selection, HIGH RF POWER and LOW RF POWER which can be selected with the RF POWER Slide switch on the side of the transceiver.

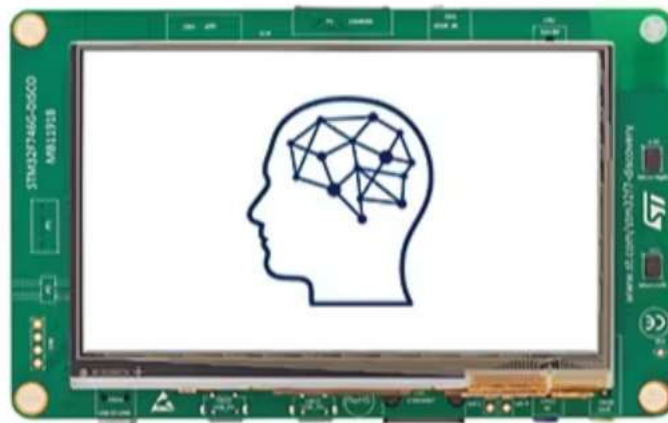
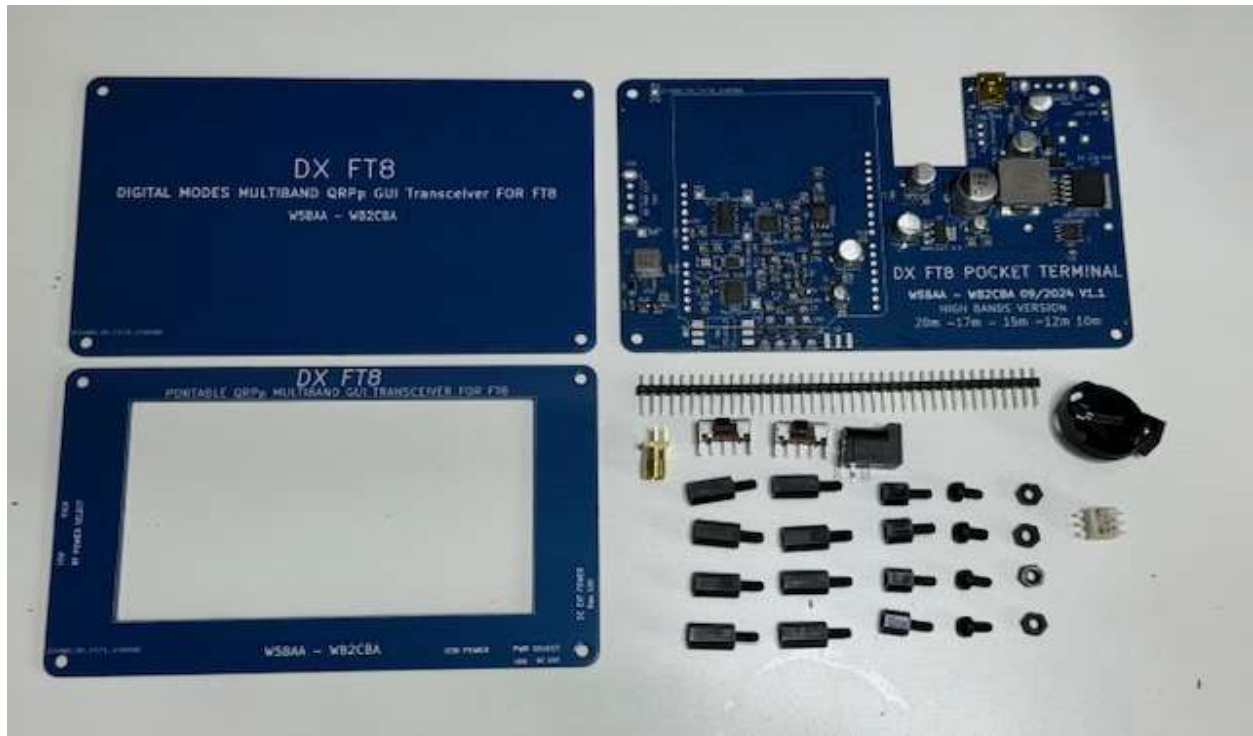
BAND	LOW RF POWER	HIGH RF POWER
20m	380mW	823mW
17m	354mW	762mW
15m	314mW	654mW
12m	259mW	520mW
10m	231mW	445mW

- DX FT8 Transceiver requires at least 1000mA power source to operate under High RF Power. DX FT8 Transceiver can operate from 5V USB power bank or any 1000mA capacity USB power source or by using DC barrel Connector can be powered from 7V to 15V external power supply capable of delivering 1000 mA. A power supply source can be selected with DC POWER SELECT slide switch located in one side of the Transceiver.
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- DX FT8 TRANSCEIVER uses an unconventional RF power Amplifier consisting of a TTL octal buffer IC and step up RF Transformer. There is no MOSFET PA transistors. This creates an extremely resilient RF PA for failure due to high SWR or no antenna

accidental operations. This is an advantage for portable operations as antenna conditions can vary.

- DX FT8 TRANSCEIVER incorporates a TAYLOE detector based Qadarature Sampling detector receiver which outputs an I and Q phase output to STM32F746 DISCO board which generates through Upper Side Band SSB receive signal.

DX FT8 GUI DIGITAL MODES TRANSCEIVER PARTS



STM 32F746 DISCO BOARD

DX FT8 TRANSCEIVER PARTS LIST

1 x STM32F746 DISCO BOARD

https://www.digikey.com/en/products/detail/stmicroelectronics/STM32F746G-DISCO/5267791?utm_adgroup=&utm_source=google&utm_medium=cpc&utm_campaign=PMax%20Shopping_Product_Low%20ROAS%20Categories&utm_term=&utm_content=&utm_id=go_cmp-20243063506_adg-ad-dev-c_ext-prd-5267791_sig-Cj0KCQjw3bm3BhDJARIsAKnHoVUr0T9QxSX-D2SV5umDLJJGErAS_3EIW0T5bXSeHToQNmqXIEHJow4aAjdREALw_wcB&gad_source=1&gclid=Cj0KCQjw3bm3BhDJARIsAKnHoVUr0T9QxSX-D2SV5umDLJJGErAS_3EIW0T5bXSeHToQNmqXIEHJow4aAjdREALw_wcB

1 x SMD POPULATED RF BOARD

Can be ordered from www.jlcpcb.com using DX FT8 Fabrication Files supplied in DX FT8 Github page. (Gerber file, BOM File for SMD parts and Fabrication footprint orientation files)

A JLCPCB SMT ordering guide is also included in DX FT8 Github page.

1 x TOP PLATE PCB

1 x BOTTOM PLATE PCB

(TOP and BOTTOM Plates can be ordered using gerber files supplied in DX FT8 Fabrication files tab under github page.)

1 x MINI CIRCUITS T2-613-1-KK81+ RF TRANSFORMER

<https://www.minicircuits.com/WebStore/dashboard.html?model=T2-613-1-KK81%2B>

1 x SMA EDGE type PCB FEMALE CONNECTOR

1 x CR2032 PCB type Battery HOLDER

https://www.digikey.com/en/products/detail/adam-tech/BH-25F-1/13537755?utm_adgroup=&utm_source=google&utm_medium=cpc&utm_campaign=PMax%20Shopping_Product_Low%20ROAS%20Categories&utm_term=&utm_content=&utm_id=go_cmp-20243063506_adg-ad-__dev-c_ext-_prd-13537755_sig-Cj0KCQjw3bm3BhDJARIsAKnHoVW0eFewJY_2avtu7ZSmm7UuU79UCobwrDua9Pfe-yc_SI0h0pVq56UaAk42EALw_wcB&gad_source=1&gclid=Cj0KCQjw3bm3BhDJARIsAKnHoVW0eFewJY_2avtu7ZSmm7UuU79UCobwrDua9Pfe-yc_SI0h0pVq56UaAk42EALw_wcB

1 x CR2032 Battery for RTC time keeping

2 x SPDT Slide Switch

<https://www.digikey.com/en/products/detail/e-switch/EG1206A/251334>

1 x PCB TYPE 2.1 mm DC BARREL CONNECTOR JACK

<https://www.amazon.com/DIKAVS-Breadboard-friendly-2-1mm-Barrel-Jack/dp/B074LK7G86>

1 x 40 pin male header

8 x M3 HEX Male end 12mm long Nylon SPACERS

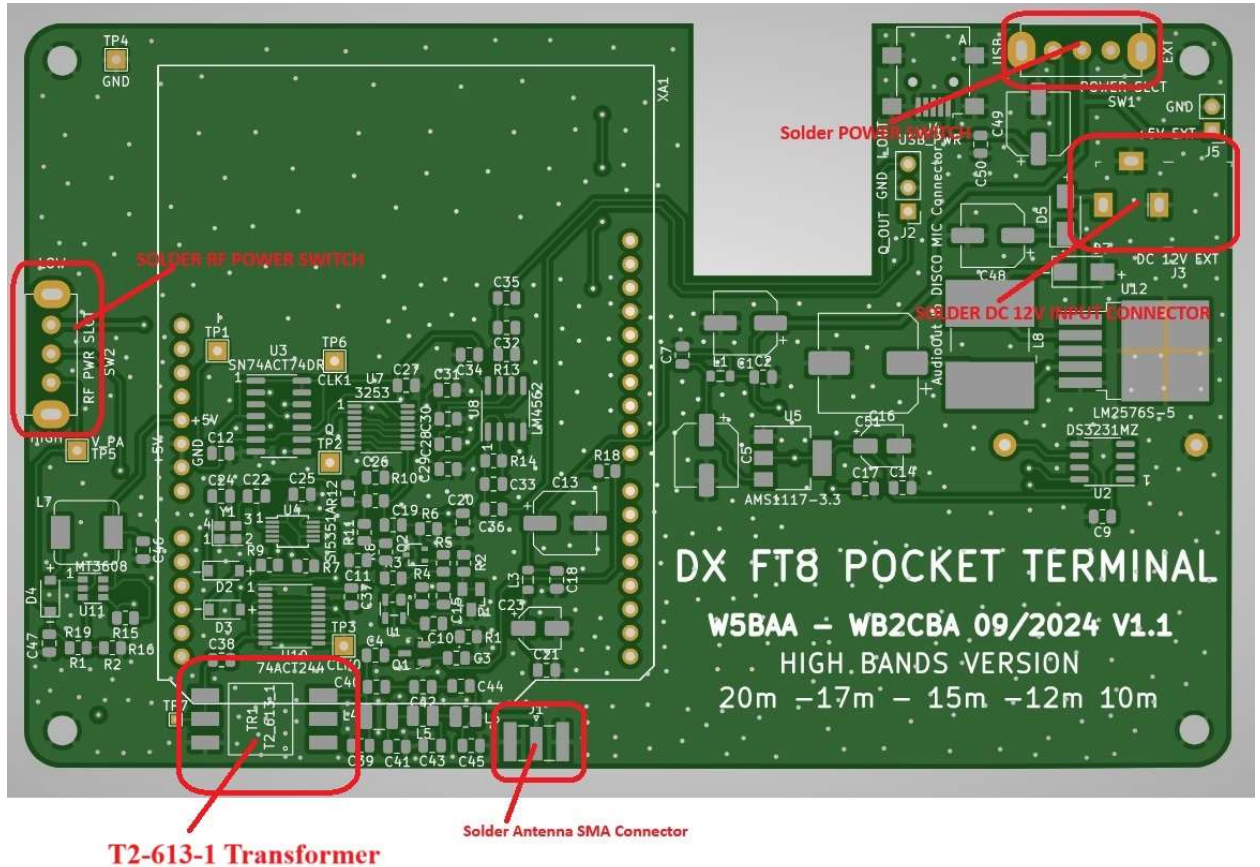
4 x M3 6mm Male end HEX Nylon Spacers

4 x M3 8mm nylon screws

4 x M3 hex nylon nuts

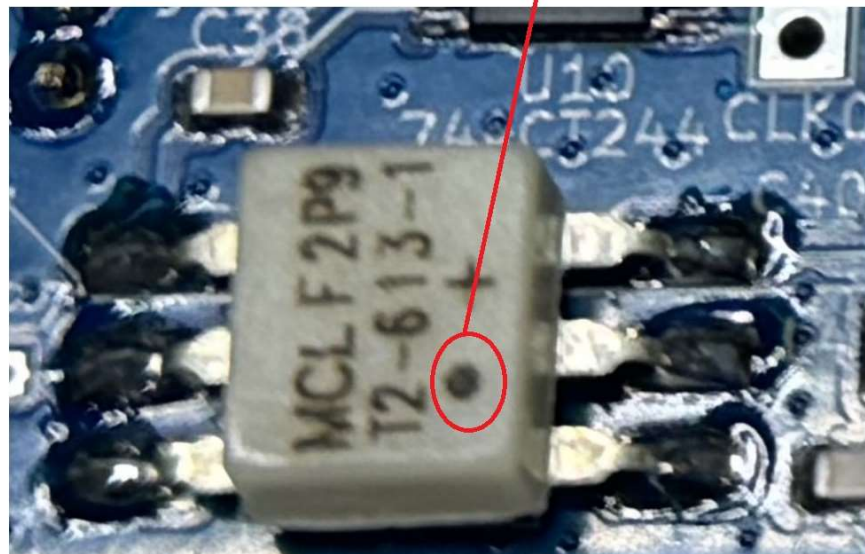
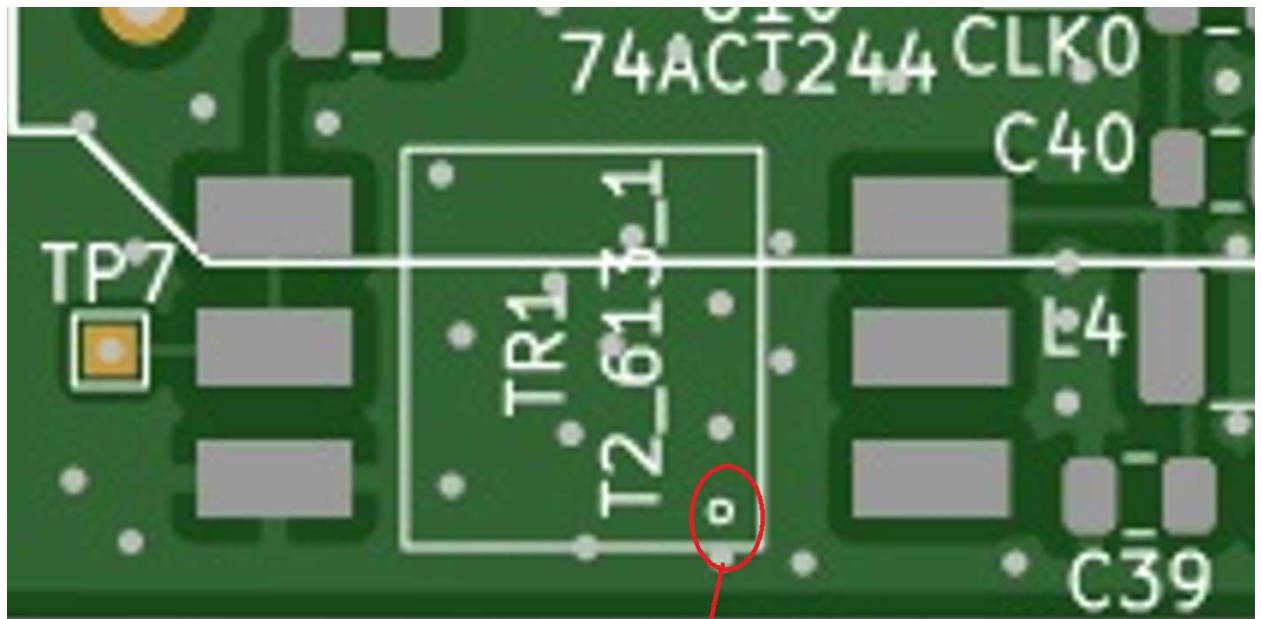
BUILDING DX FT8 TRANSCEIVER

STEP 1 :



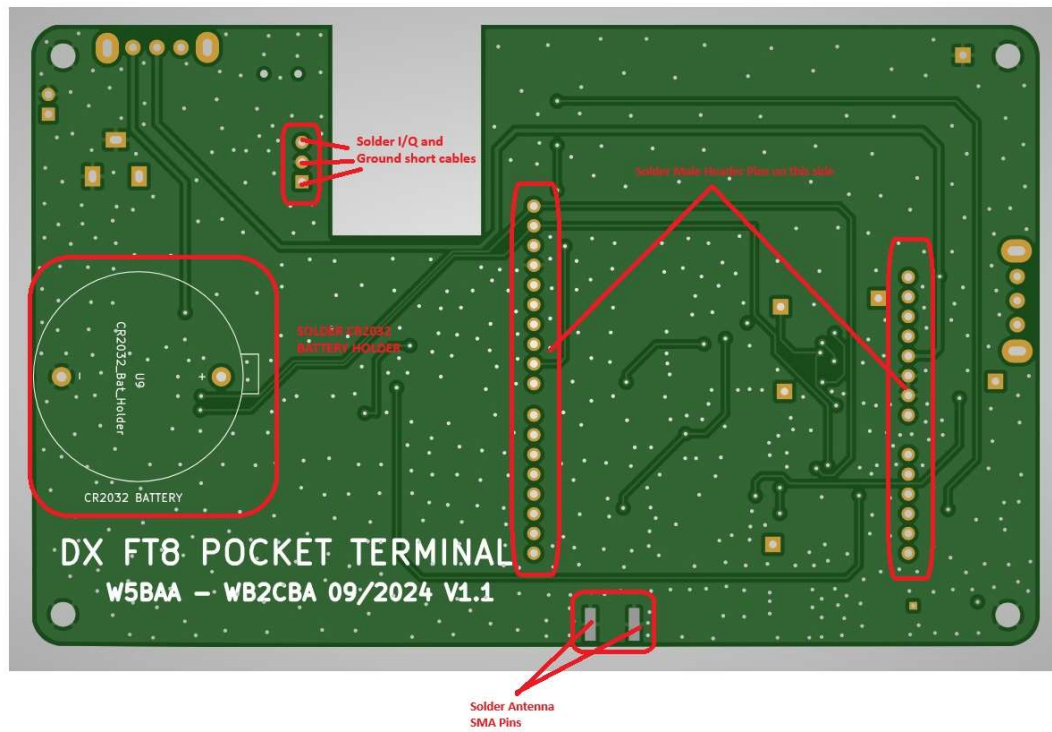
- 1- SOLDER 2 x SLIDE SWITCHES
- 2- SOLDER 1 x DC BARREL CONNECTOR
- 3- SOLDER 1 X SMA ANTENNA CONNECTOR

4- SOLDER T2-613-1-KK81+ TRANSFORMER as shown in below photo:



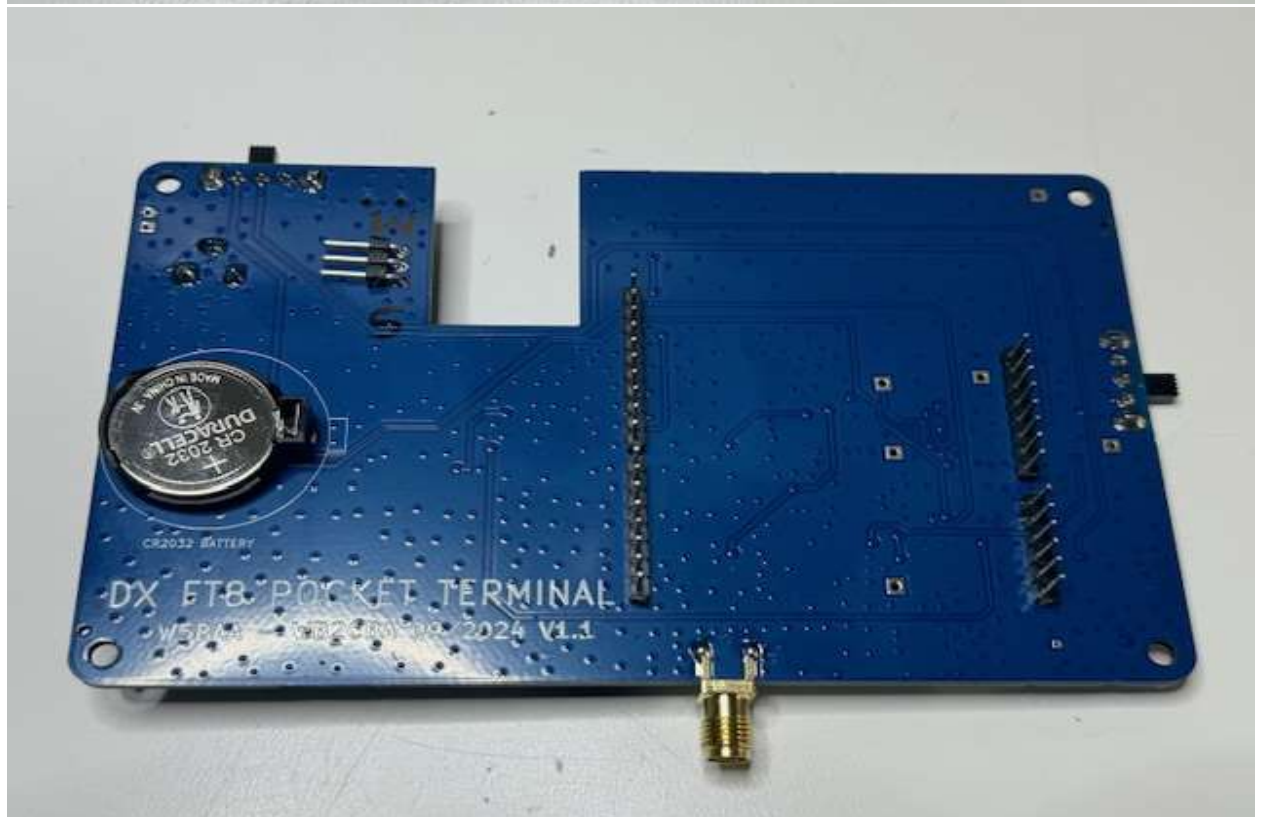
BLACK DOT on T2-613-1 transformer must match TR1 T2-613-1 PCB silkscreen dot.

STEP 2 :

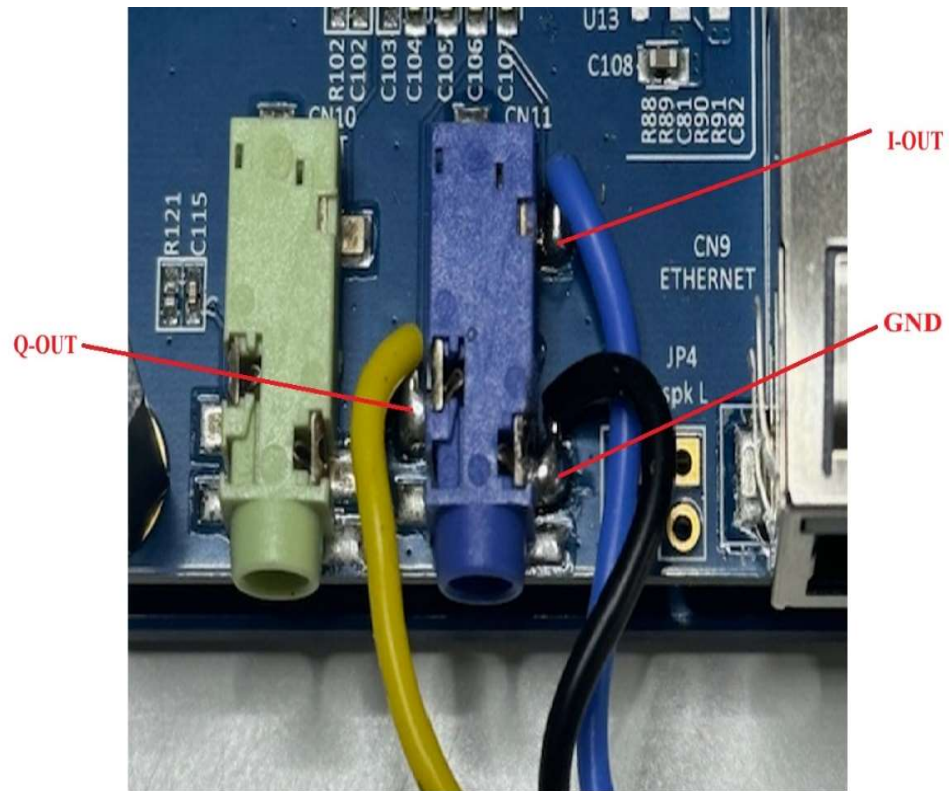


- 1- SOLDER CR2032 BATTERY HOLDER
- 2- SOLDER 1 x 6pin, 2x8pin and 1x10pin Arduino style male headers cut from 40 pin male header.

Soldered DX FT8 RF BOARD should look like this:



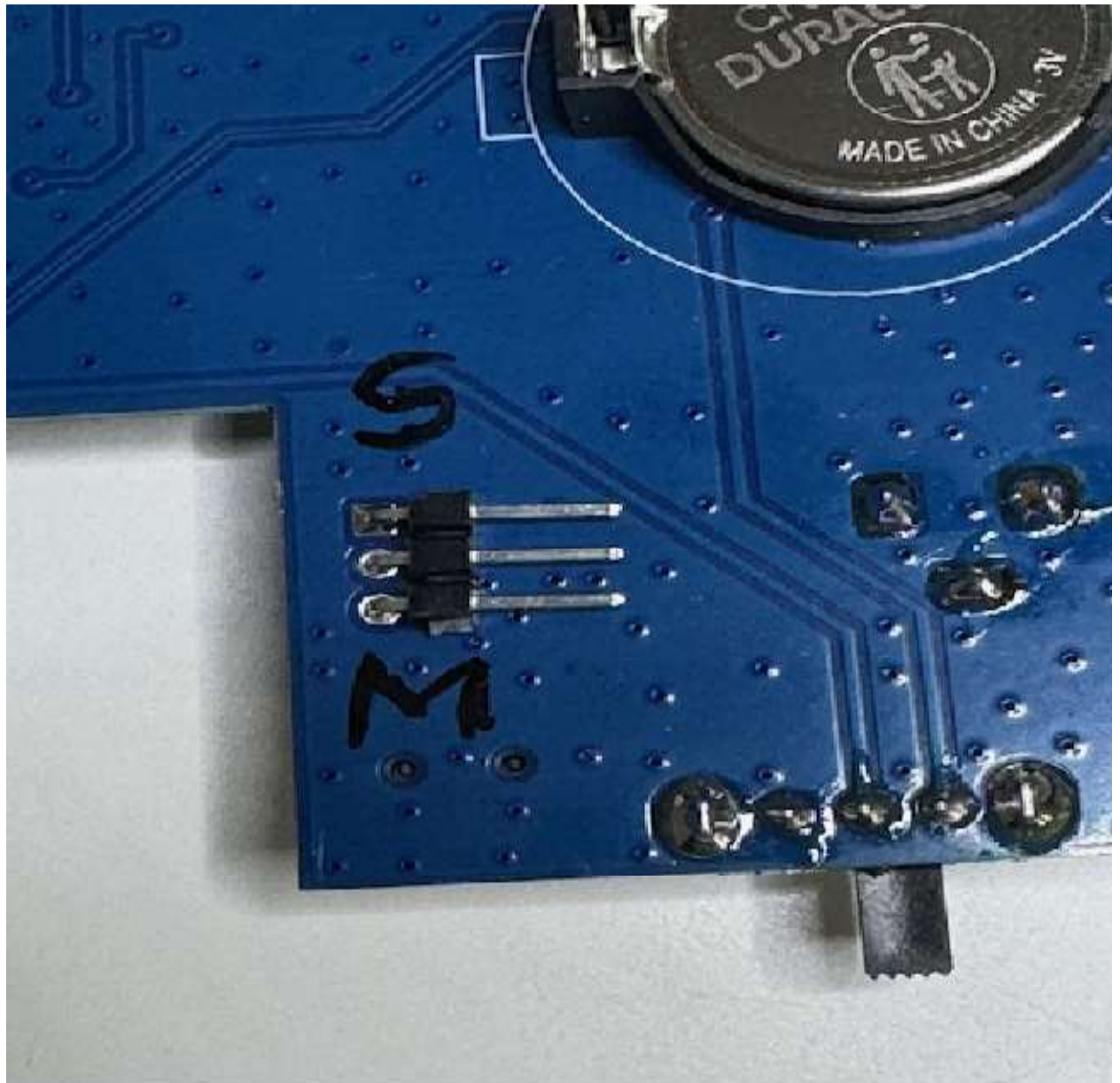
- **DISCO BOARD to RF BOARD AUDIO I/Q Connection:**
- Cut 30mm(1-1/4 inch)long 3 different colored flexible cables. Solder those cables to AUDIO out connector I,Q and GND pins on RF Board. Then Solder the other end of those cables to Disco board audio input jack as outlined in below photo. I/Q and GND is labeled on RF board component side.



DISCO BOARD AUDIO INPUT I, Q, GND CONNECTION POINTS

I used a 90 degrees header male pin on RF Board Audio out and soldered those cables to a 3 pin female header. This allows a fast connect-disconnect of Disco board and rf Board needs to be separated





When operating the transceiver if there is no reception then swap I and Q cables. This will swap USB and LSB.

Assembling Disco board to RF board and assembling Top and bottom panels



We will need these parts to assemble DX FT8 Transceiver top and bottom panels.

STEP1:

Use 4 x screws and 4 x 6mm spacers to start assembling 4 corners of top plate with screwing 4 x 6mm spacers as shown in the photos.



STEP 2:

Gently fit DISCO board to those 6mm spacers as shown in the photo.



STEP 3:

Screw 4 x 12mm spacers in place as in the photo below.



At this stage your audio cables should be soldered and ready on Disco board audio in jack.

- If you choose to solder straight to RF board connector then you should do it now at this step.
- If you choose to use a male to female header connection between Disco board audio in and RF board audio out then your male and female headers should be soldered now at this step.

STEP 4:

- Connect your audio connection between your DISCO board and RF board.
- Gently connect both boards together
- Install 4 x 12mm spacers as in the photo



STEP 5:

Screw 4 x nuts after installing Bottom plate.



Side view of your DX FT8 Transceiver should look like this:



This completes DX FT8 Transceiver assembly.

DX FT8 CONTROLS, INPUTS and Outputs



- 1- ANTENNA OUTPUT SMA JACK.
- 2- RF POWER SELECT SWITCH – Two levels of RF power output. Low power and High Power can be selected. RF power output table is at the beginning of this manual.
- 3- USB and EXT DC VOLTAGE SELECTION SWITCH – This switch allows two powering schemes, Either from a USB cable connected to a Power bank that is capable of delivering 5 Volts at 1000mAh or In the alternate position an external DC power source connected to EXT DC POWER INPUT capable of 1000mA from 7 Volts to maximum of 15 Volts. **In this input DO NOT EXCEED 15 Volts!**

- 4- USB POWER INPUT – This is Mini USB type USB input for powering DX FT8 with a USB A or USB C to Mini USB cable connected to a 5 Volts 1000 mA rating Power source.
In this input DO NOT EXCEED 5 Volts!
- 5- SD CARD SOCKET – SD Card can be a 2GB or 4GB or any less GB capacity SD Card formatted to FAT32. No need to use a large capacity SD Card as data stored is minimal.
- 6- **BEFORE Operating DX FT8 now it's time to program STM32F746 DISCO Board with DX FT8 Firmware. Please read DX FT8 Firmware programming and operation manual about How To Program Firmware and operation of Transceiver.**

This concludes DX FT8 Transceiver Hardware build.