All Mode Full Band SDR Transceiver

INSTRUCTION MANUAL

- ◉ **3D Waterfall Spectrum Diagram**
- ◉ **Built-in CW Decode, FT8 Encode and Decode**

TO USERS

Thank you for purchasing this All Mode Full Band SDR Transceiver.

New design concept, advanced software radio technology and exquisite manufacturing process are adopted for this transceiver to make it with excellent quality, complete functions and flexible operation. To experience high-performance, long-distance, multifunctional, all mode and full band voice intercom communication during the use of this transceiver.Desired functions and parameters can be selected based on personal needs to make the communication more personalized and convenient, which will bring great convenience to your work and life.

Please read all instructions carefully and completely before using the transceiver.

PRECAUTIONS

Please follow the precautions as below to prevent fire, personal injury and damage to the transceiver.

- Do not touch the antenna or antenna interface while transmitting.
- Do not operate this transceiver in flammable or explosive environment, as it may cause explosions or fires.
- The main unit of the transceiver will heat up when continuously in operation for a long time.
- Do not expose this transceiver to direct sunlight for long time, and do not place it near the heating device.
- Do not place this transceiver in areas with excessive dust, moisture or splashing water, nor on unstable surfaces.
- 13.8V DC power supply should be used, do not use any DC power supply over 16V.
- Ensure to correctly connect the polarity of DC power supply and do not remove the fuse on the power cable.
- Do not allow the interfaces inside or on the rear panel of the transceiver in contact with metal or other objects.
- Do not operate or touch the transceiver with wet hands.
- Do not place the transceiver in an environment with a temperature below -20 ℃ or above+60 ℃, especially during mobile operations.
- Please immediately cut off the power supplyof this transceiver if it emits abnormal odor or smoke.
- The transmission power of this transceiver should be set to be less than the maximum allowable input value of the power amplifier, otherwise it will damage the power amplifier.

CONTENTS

■ Supplied Accessories

The following accessories are supplied:

NO.	ITEM	QTY
1	Transceiver Unit	1
2	Hand Microphone	1
3	DC Power Cable	1
4	Instruction Manual	1
5	Fuse	2
4	Allen Wrench	1
5	Hand MIC Hook (2 Screws Included)	1

■ Main Features

- 7" multi-point capacitive touch screen (capacitive screen), 3D waterfall spectrum diagram
- Dynamic display of dashboard interface
- A+B or A&B dual channel hybrid stereo
- Bandwidth adjustable: 0Hz - 2700Hz for HPF and 100Hz - 20kHz for LPF
- Built-in KSV/power meter (KV)
- Automatic and manual notch filters
- Frequency band chart for automatic mode switching
- Digital Noise Reduction (DNR), Pulse noise reduction (NB)
- CAT virtual COM port (simulating FT-450 and TS-2000), CW port
- Spectrum analysis, SWR antenna standing-wave analysis
- SSB/FM Scanning mode
- Digital Recording
- Firmware upgrade through USB, SD and DFU

■ Connection of DC Power Cable

◆ Connection of DC Power Cable

A separate 13.8V regulated DC power supply device, with the recommended current capacity above 30A, is required to be used for this transceiver.

1. Have the positive and negative terminals of the DC power cable plugged into the power socket of this transceiver, notice that the polarity must be correct: Red - Positive (+) and Black - Negative (-).
   - Ensure to turn off the power of this transceiver and the regulated DC power supply device before connecting the power cable.
   - Two power sockets are available on the rear panel of this transceiver, which are connected in parallel and serve as backup for each other, either of them can be chose to use; It is recommended to use both two power sockets and two power cables simultaneously to increase the input current if transmitting with high power for a long time.

Red(+)
Black(-)
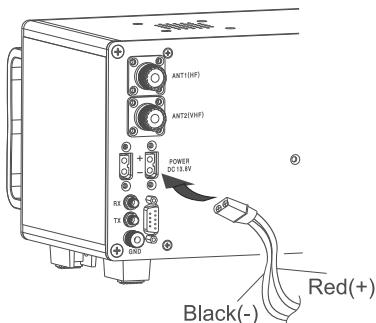
2. Have the positive and negative terminals of the DC power cable connected to the positive (+) and negative (-) terminals of the regulated DC power supply device.
   - Do not connect the transceiver to AC socket directly.
   - Have the transceiver connected to the regulated DC power supply device with the supplied DC power cable.
   - Do not replace the supplied DC power cable with cable at low wire gauge.
   - Insert the plug of regulated DC power supply device into the AC socket after connecting all cables correctly, and then turn on the regulated DC power supply device.

Fuse Box
Red(+)
Black(−)
Voltage DC 13.8V
Regulated DC Power Supply Device
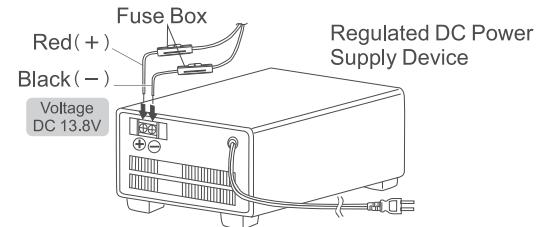
◆ Fuse Replacement

If a fuse blows, track down the source of the problem first, then replace the damaged fuse with a new 40A one.Please disconnect the power cable and contact the dealer or relevant repair center for assistance if the newly installed fuse continues to blow.

Fuse Box
Fuse
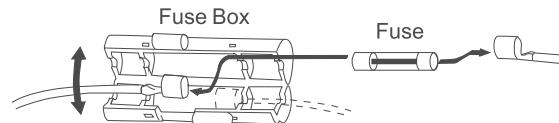
■ Antenna Connection

An antenna with impedance at 50 Ω and a low loss coaxial feeder with impedance at 50 Ω is recommended to be used to match the input impedance of the transceiver.

※ **NOTICE:** Ensure to install a matching antenna for the transceiver before transmitting, otherwise it may damage the transceiver.

Lightning arresters should be equipped for all base radio stations to reduce the risk of fire, electric shock and damage to transceiver.

Please ensure to press [POWER] key to power off before antenna connection.

Antenna Output Interface

To Antenna
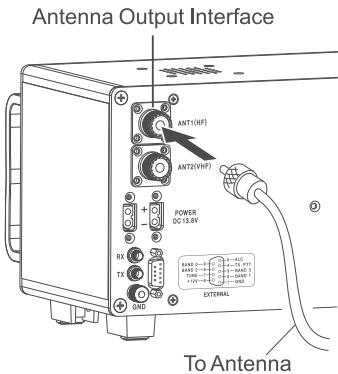
▓ Use of Brackets

The folding brackets are available at the baseplate of the transceiver for use on the desktop.
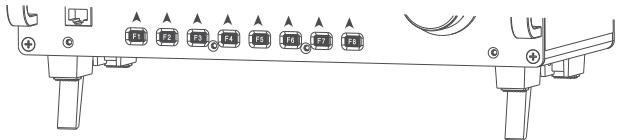
▓ Connection of Accessories

◆ Hand Microphone

To perform voice communication, please insert the supplied hand microphone plug into the standard socket on the front of the transceiver and press tightly until hearing a locking click sound.
Fix the supplied hand microphone hook at the appropriate position with the screws included in the screw set.
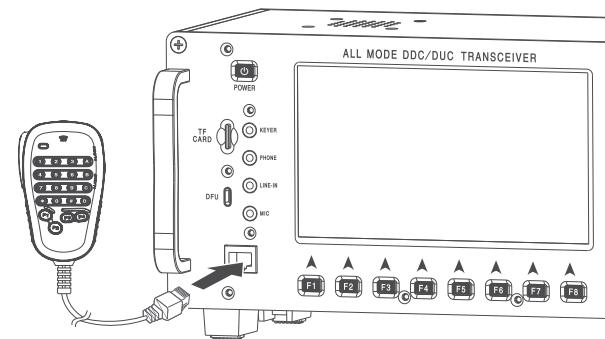
◆ External Earphone

Earphone with 3.5mm dual channel plug can be inserted into [PHONE] socket for use.

Earphone
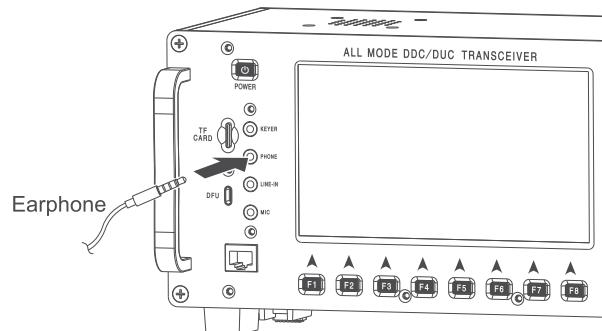
◆ CW Key

CW key can be inserted into [KEYER] socket for use.
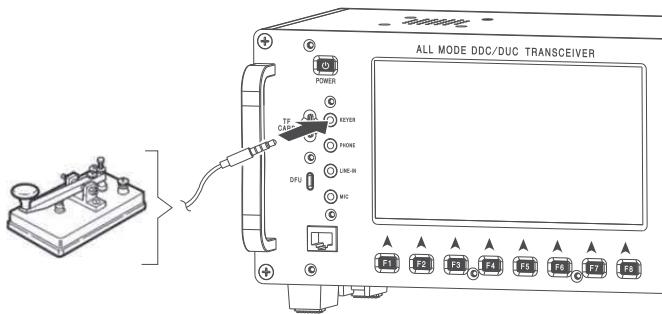
◆ Expansion SD Card

Please insert the SD card into the [TF CARD] jack to extend storage capacity with maximum 32GB.

Card direction
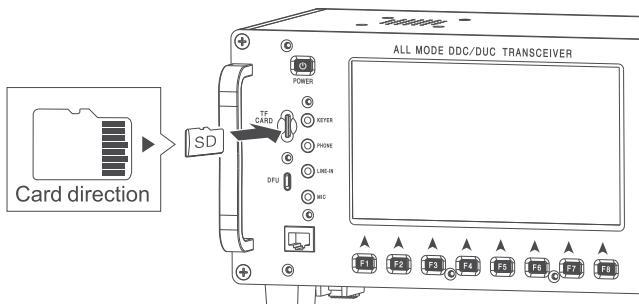
PANEL DESCRIPTION

■ Front Panel

Display Screen
Handle
ALL MODE DDC/DUC TRANSCEIVER
① POWER
⑯
⑮ KEYER
TF CARD
⑭ PHONE
⑬ LINE-IN
DFU
⑫
⑪ MIC
⑩
SHIFT/GAIN FUNC AF-GAIN
② ③ ④
A/B MODE BAND
⑤
⑥
⑦
Handle
F1 F2 F3 F4 F5 F6 F7 F8
Folding Bracket
⑨
⑧ Folding Bracket
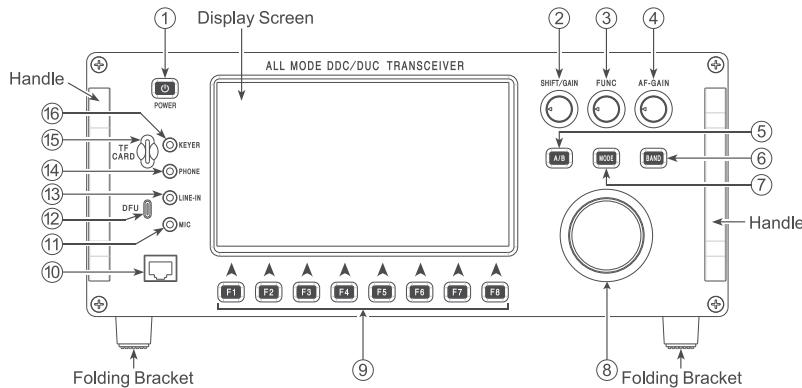
① **[POWER] Power Button**
 ● Press this button to power ON/OFF.

② **[SHIFT/GAIN] Knob**
 ● Rotate this knob to adjust Intermediate Frequency (IF) Gain, which is set by minimum noise.

③ **[FUNC] Knob/Button**
 ● Sub-encoder for menu navigation or fast access functions.
 ● Press this button to change adjustment mode.
  FAST STEP - Fast Frequency Hopping
  SET WPM - Automatic Keystroke Speed
  SET RIT - Receive Tuning
  SET NOTCH - Notch Filter Setting (If manual mode is enabled)
  SET LPF - Bandpass LPF Setting
  SET HPF - Bandpass HPF Setting
  SET SQL - FM Squelch Threshold Setting

 ● Rotate this knob to adjust the setting value of the current mode.
 ● Press this button to confirm the current option in menu operation mode.

④ **[AF-GAIN] Volume Knob**
 ● Rotate this knob to adjust the audio output volume.

⑤ **[A/B] Button**
 ● Press this button to switch between primary and secondary frequencies: Frequency A and Frequency B.

⑥ **[BAND] Button**
 ● Frequency band selection, long press - memory frequency, repeatedly press – memory frequency.
 ● Press this button to view menu items backwards in menu operation mode.

⑦ **[MODE] Button**
 ● Press this button to switch receiving mode.

⑧ **Main Tuning Knob**
 ● Rotate this knob to adjust frequency under standby state.
 ● Rotate this knob to adjust output power while transmitting.

⑨ **Softkeys [F1] ~ [F8]**
 Function keys, the functions are changed based on the mode, corresponding to the screen keys at the bottom of the screen.
 ● These programmable keys can be defined as different functions through the control menu settings, please refer to the instructions on the next page for details.

⑩ **Hand Microphone Socket**
 ● Insert the supplied hand microphone plug into the socket to perform intercom and function operations.

⑪ **[MIC] Microphone Interface**
 ● Connect the microphone and input audio when speaking to the microphone.

⑫ **[DFU] Interface**
- USB interface (Type C) connected to PC.
- Used for firmware upgrade and flashing in DFU mode.
- Connect the internal USB digital sound card port to transfer digital audio in working condition.

⑬ **[LINE-IN] Interface**
- Connect the PC audio output to modulate the input of the audio signal.

⑭ **[PHONE] Earphone Socket**
- For connecting stereo earphones.
- Do not insert mono headphones.

⑮ **[TF-CARD] SD Memory Card Socket**
- Used for recording set values and call content, copying screen status (screenshot), firmware upgrade (flashing), etc.

⑯ **[KEYER] Interface**
- CW key interface, used to input the Morse code and send out.

■ Softkeys

Softkey icons are displayed at the bottom of touch screen and the physical buttons [F1]～[F8] correspond to the functions assigned to the softkeys for easy operation.

| A/B | ➡ | B=A | ➡ | TUNE | ➡ | POWER | ➡ | XIT | ➡ | RIT | ➡ | SERVICE | ➡ | MENU |

| SNAP‹ | ➡ | SNAP› | ➡ | DOUBLE | ➡ | SPLIT | ➡ | SCAN | ➡ | CQ | ➡ | REC | ➡ | MENU |

| HPF | ➡ | MODE- | ➡ | MODE+ | ➡ | BAND- | ➡ | BAND+ | ➡ | BANDMP | ➡ | AUTOGN | ➡ | MENU |

| SAMPLE- | ➡ | SAMPLE+ | ➡ | ZOOM- | ➡ | ZOOM+ | ➡ | SQL | ➡ | WPM | ➡ | LOCK | ➡ | MENU |

| MACRO1 | ➡ | MACRO2 | ➡ | MACRO3 | ➡ | MACRO4 | ➡ | MACRO5 | ➡ | CESSB | ➡ | VOX | ➡ | FILES |

| FT8 | ➡ | ANT |
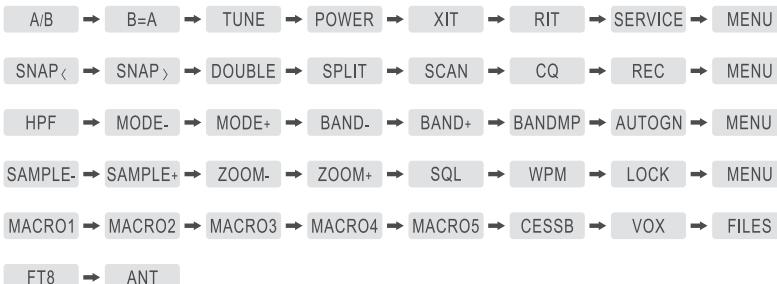
※**Notice:**
- After entering various menu items, press [F8] key to return to the previous level menu items until the main interface.

- The sequence of the key icons can be set by pressing the software MENU to select "SCREEN Settings" and then pressing the [FUNC] button (knob) to enter the next menu item "Func button 1-36" and set, with a total of 36 softkeys available for setting.

◆ Softkey Selection

Touch screen to scroll and select the corresponding button function and assign to the softkeys [F1] ~ [F8]. Press the corresponding softkey under the function icon to select the desired function.

◆ Softkey Function Description

| Softkey	Description
A/B	Switch between Frequency A and Frequency B.
B=A	Copy the information of Frequency B to Frequency A.
TUNE	Antenna tuner switch, press to highlight the icon while load automatic antenna tuner; Press again to gray the icon while no load automatic antenna tuner.
POWER	Transmission output power selection, with a total of 10 levels as 0%~100%.
XIT	Transmitting offset.
RIT	Receiving frequency offset adjustment.
SERVICE	Enter service setting menu.
MENU	Main menu
SNAP‹	Automatically track strong signals on the left side.
SNAP›	Automatically track strong signals on the right side.
DOUBLE	Dual frequency receiving mode. A – VFO-A only; B – VFO-B only; A+B - Mixing of both VFO in two earphones; A&B - A in the earphone on the left while B in the earphone on the right.
SPLIT	Split frequency operation, receiving on the current main frequency and transmitting on the sub frequency (Cross-band available).
SCAN	Scanning function. Scan frequency bands or channels to search for signals.
CQ	Automatic voice call, transmit the audio signal pre-recorded into the memory card.
REC	Record the current signal into the SD card to save.
MENU	Main menu

Softkey	Description
HPF	Enter the high-pass filter menu.
MODE-	Mode Selection: FM/SSB/CW etc.
MODE+	Mode selection in one group, such as NFM/WFM,LSB/USB.
BAND-	Band selection downwards.
BAND+	Band selection upwards.
BANDMP	Automatic mode switch, select a mode from the current area within the range.
AUTOGN	Automatic gain switch. ATT, DRV and PGA are allowed to be automatically controlled by the transceiver, preventing users from controlling these functions.
MENU	Main menu.
SAMPLE-	Reduce the sampling rate and bandwidth of waterfall.
SAMPLE+	Increase the sampling rate and scanning range of waterfall.
ZOOM-	Spectrum zoom out.
ZOOM+	Spectrum zoom in.
SQL	Squelch menu.
WPM	CW automatic keystroke speed.
LOCK	Lock or unlock the touch screen. Press to lock the touch screen while press and hold to unlock the touch screen.
MENU	Main menu.
MACRO1	First pre-recorded MORSE code signal.
MACRO2	Second pre-recorded MORSE code signal.
MACRO3	Third pre-recorded MORSE code signal.
MACRO4	Fourth pre-recorded MORSE code signal.
MACRO5	Fifth pre-recorded MORSE code signal.
CESSB	Voice compression function in SSB mode.
VOX	Voice control function.
FILES	File management.
FT8	FT8 operation menu.
ANT	Transmitting antenna selection.

■ Display Screen
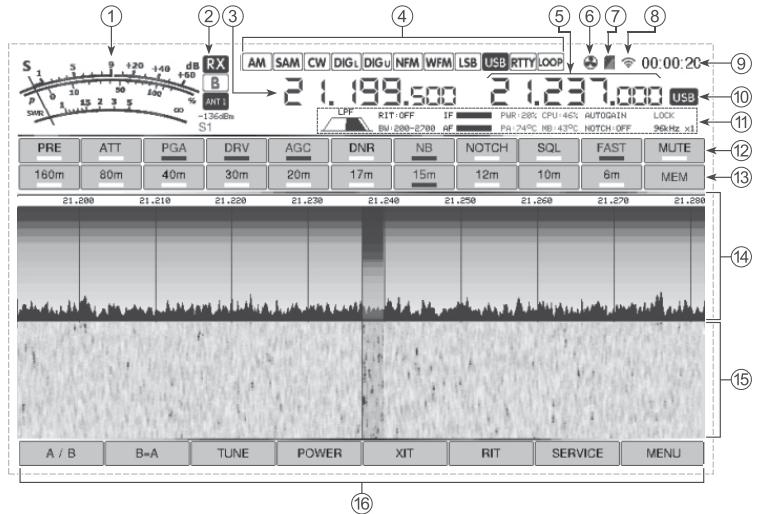
① S-meter instrument panel indication, from top to bottom, showing:
- Receiving signal strength indication.
- Transmitting power level indication.
- SWR standing-wave indication.

② ● TX/RX/TUNE Mode: Current receiving mode.
   A: VFO-A only;
   B: VFO-B only;
   A+B: Mixing of both VFO in two earphones;
   A&B: A in the earphone on the left while B in the earphone on the right.
   ● ANT1/ANT2: Transmitting antenna selection.
   Touch this area to switch ANT mode.

③ Current VFO-A frequency, touch to enter the band selection interface.

④ Operating mode of current VFO-A frequency, highlight with different colors after touching.

⑤ Current VFO-B frequency, touch to enter the band selection interface.

⑥ Cooling fan status indication.

⑦ SD card status indication: The icon is highlighted when SD card is inserted while it is gray when not.

⑧ Clock display: Automatically synchronized or manually set.

⑨ Operating mode of current VFO-B frequency, touch to select different modes.

⑩ Status display area for current operating frequency, instructions as follows:

```
LPF    RIT:OFF    IF ████  PWR:20% CPU:46% AUTOGAIN    LOCK
       BW:200-2700 AF ████  PA:74°C MB:43°C NOTCH:OFF    96kHz ×1
```
(11-1)   (11-2)   (11-3) (11-4)
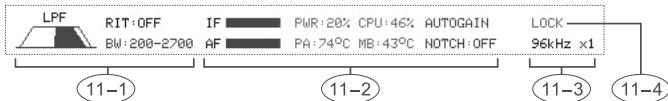
(11-1) Bandpass low-frequency filter status indication.
● RIT: Audio offset.
● BW: Bandwidth selection of bandpass filter, touch this area to pop up the bandwidth selection menu with different settings for each module. The transmitted bandpass filter is configured if you touch this area while transmission.

(11-2) Transceiver status indication.
IF: Intermediate Frequency (IF) status bar display.
AF: Current receiving volume bar display.
PWR: Transmitting power percentage display.
PA: RF power amplifier tube temperature display.
CPU: CPU load percentage display.
MB: Main board temperature display.
AUTOGAIN: Automatic gain corrector.
NOTCH: Notch filter.

(11-3) Spectrum width

(11-4) Lock the buttons, knobs, and screen. Press and hold softkey [LOCK] to unlock.

⑫ Working status display area, instructions as follows:

PRE   Enable LNA (Low Noise Pre-Amplifier).

ATT   Enable attenuator, press and hold for electrical level selection. The attenuator will be automatically adjusted with no responding to the user's selection when the automatic adjustment is enabled.

PGA   Enable ADC built-in "Pre-Amplifier".

DRV   Enable ADC Driver.

AGC   AGC control: Automatic gain control for receiving signals.

DNR   DNR1: Level 1 digital noise processor；
DNR2: Level 2 digital noise processor， which is the most powerful, with processing threshold adjusted in settings, it will make a gurgling sound if overset.

NB   Pulse interference suppressor.

NOTCH Press to activate automatic notch filter while press and hold to activate manual filter (controlled by [FUNC] knob).

SQL   Enable squelch, press and hold for squelch level setting, the squelch level in FM mode is displayed on S-meter.

FAST   Frequency step acceleration.

MUTE   Mute the transceiver. Press to mute the transceiver speaker, press and hold to mute the speaker but earphone.

⑬ Band display. Touch for quick band selection, MEM refers to memory band.

⑭ FFT (Spectrum), with one color line showing the boundary of pattern/scope, do not beyond the boundary when using.
● Touch this area for tuning to the desired frequency range；
● Slide this area for moving smoothly along frequency；
● Pull open/close with 2 fingers for spectrum zoom in/out.

⑮ Waterfall (WTF), waterfall in different forms of 2D and 3D can be displayed.

⑯ Softkeys and status
● Slide the softkey scroll bar left and right to select desired softkey.

■ Rear Panel

Folding Bracket   Cooling Fan   Folding Bracket
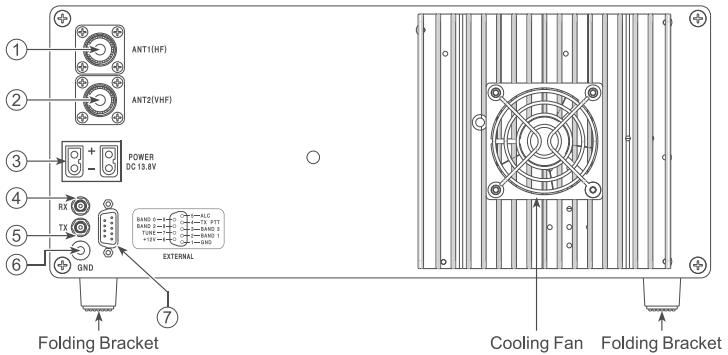
① **[ANT1(HF)] Antenna Port**
For connecting external HF antenna with impedance at 50Ω.

② **[ANT2(HF)] Antenna Port**
For connecting external VHF antenna with impedance at 50Ω.

③ **DC13.8V Power Cable Jack**
For connecting supplied DC13.8V power cable.

④ **[RX] Antenna Port (Optional)**
Have the signal to the RF amplification part of the transceiver directly, skipping the low-pass filter.

⑤ **[TX] Antenna Port (Optional)**
The RF signal from the transceiver DA conversion section is directly output from this interface.

⑥ **[GND] Grounding Terminal**
General grounding terminal of the transceiver. The grounding terminal should be well grounded to prevent issues such as electric shock and interference with television broadcasting. Connect the grounding rod with a thick wire and keep the wire length as short as possible .

⑦ **[EXTERNAL] External Interface**
A total of 9 pins are available for the external interface with descriptions as follows:
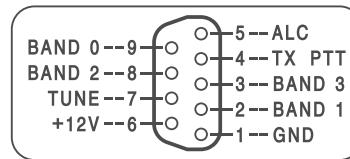
EXTERNAL

1. **GND:** Grounding
2. **BAND1:** BCD band identification signal 1
3. **BAND3:** BCD band identification signal 3
4. **TX PTT:** Grounding while transmitting, or transmit immediately after grounding
5. **ALC:** Connected to the ALC output socket of power amplifier for automatic control on output power
6. **+12V:** Power supply +12v, maximum current at 1A
7. **TUNE:** Antenna tuner control signal, used to enable, disable or activate antenna tuner.
8. **BAND2:** BCD band identification signal 2
9. **BAND0:** BCD band identification signal 0

Microphone (Multi-functional Hand Microphone)
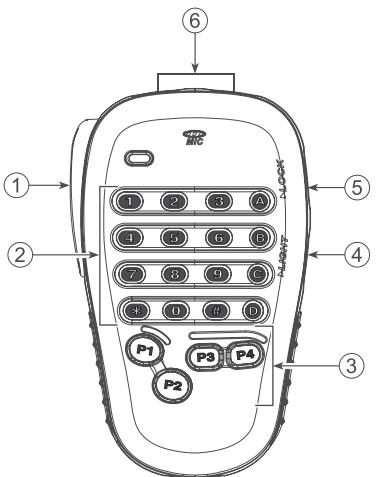
① **[PTT] Button**
   Press and hold this button to transmit while release to receive signal.

② **Numeric Keypad (DTMF Keypad)**
   A total of 16 keys are available and can be customized by users through the menu, the factory default functions of each key are as follows:

   ①   AGC: Automatic gain control for receiving signals.
   ②   A/B: Switch between Frequency A and Frequency B.
   ③   BAND-: Band selection downwards.
   Ⓐ   BAND+: Band selection upwards.
   ④   UP: Frequency selection upwards.
   ⑤   Switch between VFO-A and VFO-B.
   ⑥   BAND-: Band selection downwards.
   Ⓑ   BAND+: Band selection upwards.
   ⑦   DOWN: Frequency selection downwards.
   ⑧   A/B: Switch between Frequency A and Frequency B.
   ⑨   BAND-: Band selection downwards.
   Ⓒ   BAND+: Band selection upwards.
   ✳   AGC: Automatic gain control for receiving signals.
   ⓪   A/B: Switch between Frequency A and Frequency B.
   #   BAND-: Band selection downwards.
   Ⓓ   BAND+: Band selection upwards.

③ **Programmable Function Keys (Key P1/P2/P3/P4)**
   These 4 keys can be customized by users through the menu as follows:
   P1   AGC: Automatic gain control for receiving signals.
   P2   A/B: Switch between Frequency A and Frequency B.
   P3   BAND-: Band selection downwards.
   P4   BAND+: Band selection upwards.

④ **Keypad Lamp Switch [LAMP]**
   Turn on the MIC keypad lamp.

⑤ **Lock Switch [LOCK]**
   Lock [UP]/[DWN] keys to prevent pressing them from changing the operating frequency.

⑥ **[UP]/[DWN] Keys**
   While unlocking, press these two keys for frequency selection upwards or downwards.

It is suggested to operate on the 7" multi-point capacitive touch screen with a capacitive stylus for more precise operation of the transceiver.
The basic function operation descriptions are as follows:

■ Power ON/OFF

Ensure that the following connections are completed correctly before turning on the transceiver for the first time.
● DC Power Cable
● Antenna
● Grounding Wire
● Hand Microphone
Press [POWER] Power Button to power ON/OFF.

■ Volume Adjustment

Rotate [AF-GAIN] Volume Knob to adjust volume, rotate clockwise to turn volume up while counterclockwise to turn volume down.

◆ RF GAIN can be appropriately reduced for good reception effect if the receiving background noise is too loud.

■ Select Operating Band and Frequency

◆ Touch the corresponding operating frequency band on the main display interface screen lightly to switch to the current operating band.
◆ Or press [BAND] button for loop selection of operating band.
◆ Or press the softkeys ([F1] ~ [F8]) assigned with [BAND+] or [BAND-] for loop selection of operating band.
◆ Touch the current VFO operating frequency (MHz) to enter the band selection interface as follows:

2200m	160m	80m	40m	30m	20m
17m	15m	12m	CB	10m	6m
2m	70cm	MEM			

LW	MW	120m	90m	75m	62m
49m	41m	31m	25m	22m	19m
18m	16m	13m	11m	FM	

◆ Rotate the main tuning knob to select the correct operating frequency.

■ Select Operating Mode

◆ Touch the corresponding options of operating mode in the row above the frequency on the main display interface screen to activate the current operating mode when the main frequency (VFO-A) is in use, as shown below.
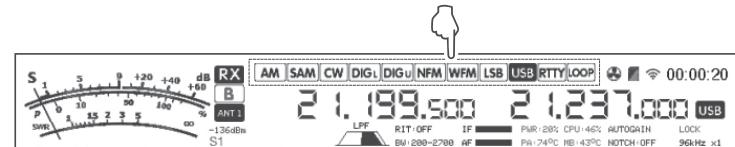
◆ Touch the operating mode on the main display interface screen to enter the operating mode selection when the sub frequency (VFO-B) is in use, as shown below.

LSB	USB	CW	NFM
WFM	AM	SAM	DIGL
DIGU	IQ	LOOP	RTTY