Welcome to the uv-k5-firmware-custom wiki!

On this wiki the (custom and extended) functions are described, which have been realized with this adapted firmware (releases).

This firmware unlocks the full frequency range of the radio and expands the capabilities of the Quansheng UV-K5 (-serie).
Original range 50 - 600 Mhz and now 18 MHz ~ 660 MHz and 840 ~ 1300 MHz. Note: *The RF BK4819, is the basis of the radio, has a hardware limitation (630 - 840 Mhz.)*.

Some of the other capabilities is the ability to receive in various modes (FM, AM and USB). The screen has an TX-audio signal strength indication and RX signal strength indication (S-meter) and the possibility to show channelname and frequentie of both VFO's. **Warning**: Modifying a radio may violate various laws or regulations of some nations. Not all of these capabilities will be allowed in order to comply with various regulations.

- This *Manual* is located as Wiki at https://github.com/egzumer/uv-k5-firmware-custom/wiki.

Chapters

Basic operation & configuration

Radio display is split into upper VFO and lower VFO. You can change upper/lower selection by pressing F + 2 A/B (or by long press 2 A/B).

Each VFO can operate independently of each other function in either frequency or channel mode. To switch modes select the desired VFO and press F + 3 VFO/MR (or long press 3 VFO/MR).

In the frequency mode you manually type in the frequency with the keypad. You can also switch different options for that VFO in the menu (first 13 menu entries). If you setup the VFO, the settings can be saved to a memory channel by going into the menu ChSave and choosing the memory channel the VFO should be saved into.

In the channel mode you can switch between saved memory channels. Memory channels can be added manually as mentioned before or with a computer software. You can use either Quansheng Portable Radio CPS or the recommended open source software called Chirp.

Frequency/Memory scanning

Frequency scanning

To start a frequency scan switch a VFO in frequency mode. Set a start frequency. Set a frequency step (menu Step). Start scanning with custom button scan function or by long pressing the * Scan button.

Scan frequency range function

- switch to frequency mode
- set upper and lower VFO frequencies to scan range boundaries
- long-press 5 NOAA, ScnRng label should show up
- start scan with long-press * Scan
- it will scan between given boundaries
- long-press 5 NOAA or EXIT, or switch VFOs to exit ScnRng mode

Memory-channels scanning

To scan channels saved in the radio memory switch the VFO to Memory mode.

The radio has 2 scanning lists. Each memory-channel can belong to 0, 1 or 2 lists. To add/delete a channel to/from a list switch current VFO to desired channel and go to a menu ScAdd1 or ScAdd2, alternatively you can long press 5 NOAA button, you will see icons I and II toggling on and off on the right side of the channel label.

If you set up the scanning lists you can start scanning by using custom button scan function or by long pressing * Scan button. If you press the function button or long press * Scan while scanning, the scanning list will be switched, you will see corresponding icon on the top left of the screen: 1, 2 or * (star means: All memory channels). Active scanning list can also be changed with menu SList. You can view scan lists and its channels by going to menu: SList1 or SList2.

Common frequency/channel scanning features

You can change the scan direction while scanning with UP/DOWN buttons.

The scan can be stopped with the EXIT button, the search result will be ignored and frequency/channel will return to the one that was set before scan begun. Alternatively you can stop the scan with PTT or MENU button in which case the frequency/channel will be set to the last channel where transmission was found.

Single frequency scanning (frequency copy), DCS/CTCSS scanning

This function will allow you to find out and copy frequency and coding settings. The frequency search will only work for strong signals. The transmitting radio has to be close. To start a frequency copy (FC) function use 4 FC function button. Scanner screen will open. Push and hold a PTT button on the other radio. Wait couple of seconds until frequency and code (if used) appears on the screen. The settings can be saved with the MENU button. The settings will be save either to a channel or the main VFO, depending in which mode you started the scan.

You can also search only the DCS/CTCSS code for a frequency set on the main VFO. Choose desired frequency or channel and press F + * SCAN. The same screen will appear, but the frequency search will be omitted, instead the frequency of the main VFO will be used. Wait for a signal to appear or press the PTT on the other radio. It takes 1-2sec for the code to be found. The save procedure is the same as above.

There is another option of DCS/CTCSS code scanning. Choose desired frequency or a channel. Go to the menu RxDCS or RxCTCS. Enter the menu option and press * SCAN button. A SCAN label will appear. Wait for a radio signal or press the PTT button on the other radio. When code is found the SCAN label will disappear, to save confirm the option with the MENU button. It doesn't matter on which of the two menu items you start the scan. Both DCS and CTCSS will always be found, and the menu entry will be changed to the correct one.

1750 Hz toneburst for repeater access

When the PTT is pressed, the 1750 Hz can be activated by pressing Function-button-II (*side key 2, bottom*)

DTMF calling (decoding)

DTMF calling can be turned on in the menu D Decd (DTMF Decoding). You need a computer and programming cable to setup the whole system. You need to change ANI ID (programmable from the computer) of each radio to be unique in your network. It is also a good idea to program the list of contacts, their IDs and names.

The basic idea is to be able to dial a one particular person (or a group) among many on the same frequency. If you turn on the DTMF calling on a given channel your radio will be silent on that channel until an incoming call arrives with the destination ID matching ANI ID of your radio. If you receive the call a time window opens up in which the speaker activates and a person on the other side can talk to you. The time window expires after a delay set in D Hold menu entry from the time when incoming signal disappears.

The call pattern is recipient*sender where recipient is the ANI ID of a radio to which the call is being sent to, and sender is ANI ID of a radio that transmits the call (e.g. 102*103). In QS radio you only need to enter the recipient ID, the rest is appended automatically. You can send the call in two ways. One is, you go to the menu D list and choose a contact from the list and hit MENU button, its ID will be copied to the DTMF input box. You can transmit the call with PTT button. You can also open the DTMF input box by short press * SCAN button, and enter 3 digit recipient ID and hit PTT to send. You can use # wildcard in place of any of the ID digits to make a group calls where every radio matching the pattern will activate. In particular you can call ### to call everyone.

Menu items for DTMF calling:

- ANI ID - ID of your radio.
- D ST - DTMF site tone, whether you want to hear the tones in your speaker while they are being sent
- D Resp
    - DO NOTHING - does nothing
    - RING - radio beeps while the receiving time window is active
    - REPLAY - sends a DTMF call back to the caller
    - BOTH - both REPLAY and RING
- D Hold - length of a receiving time window
- D Prel - DTMF call preload, time from the RF path activation to when the DTMF codes start being sent, higher value gives the receiving radio time to detect the signal and open squelch on time so it will not loose the codes
- D Decd - turns on the DTMF decoding
- D List - list of DTMF contacts

TX on all bands

Warning

This modification is UNTESTED and is for RESEARCH PURPOSES ONLY, to explore the capabilities of the device and its chipset. DO NOT transmit on illegal frequencies. DO use a dummy load. The author(s) and contributor(s) of this repository are NOT liable for any damages, litigation, or other consequences of the misuse of this research firmware and do not accept any culpability. By installing any firmware from this repository, you accept full responsibility for any consequences that may arise and waive the right to pursue legal action against the author(s).

This option won't give you ability to transmit in any other modulation than FM, this is a hardware limitation. Switching to AM or SSB only switches AF audio output mode of a RF IC. It doesn't switch the whole IC into AM/SSB mode. This is for listening only. This firmware is also built with additional lock that blocks TX when AM or SSB is on.

As an example against using this for actual communications, consider the following chart for transmission power for a transmission at 27.254MHz:

- 27.254MHz -> **228 microwatts**
- 54 Mhz -> 2.4 milliwatts
- 81 Mhz -> 230 milliwatts
- 109 Mhz -> 558 milliwatts
- 136 Mhz -> 412 milliwatts
- 163 Mhz -> 122 milliwatts
- 190 Mhz -> 14.8 milliwatts
- 218 Mhz -> 2 milliwatts
- And finally, on 245 Mhz -> 2.6 milliwatts.

How to unlock TX on all bands

1. Go to hidden menu
2. Enter menu F-Lock
3. Choose option UNLOCK ALL
4. Repeat steps 2-3 10 times. Do it carefully, if you confirm any other option in the process counter will get zeroed and you will have to repeat that 10 times more.

Menu operation

The menu can be accessed with the M button *(short press)*.

Once in the main menu, the menu items will be displayed on the left-hand side of the screen. The currently selected menu item will be highlighted and current value for that menu item will be shown on the right. Also, at the bottom left side a number of the menu item will be shown, ranging from 01 to the highest number.

To find the menu item to access, the UP/DOWN arrow keys may be used, or the ***menu item number*** (see lists below) may be entered on the numeric keypad. For instance, to access the VOX settings a number 57 can be entered on the keypad.

Once the desired menu item is highlighted, pressing the Menu key will enter into that menu item.

Once the menu item is selected, pressing the up and down arrow keys will adjust the setting for that menu item. To confirm the selection, press the Menu key. To cancel the selection, press the EXIT key.

Main menu

The number in front of the menu-item-description is a ***menu item number*** that can be used for quick selection.

1. Step - step of the frequency (in kHz), up/down buttons change frequency by this value, also you can only set a frequency that is multiple of this value.
   2.50/5/6.25/10.00/12.50/25.00/8.33 are the steps that can be set by programming software, all other steps are extension from standard software, and can only be selected from this menu entry.
2. TxPwr - radio output power (LOW/MID/HIGH)
3. RxDCS - receiver Digital-Coded Squelch, if you enable this, squelch will only unlock if this code is being received. You can start a DCS/CTCSS scan while you are in this menu option by pressing * SCAN button
4. RxCTCS - receiver Continuous Tone-Coded Squelch System, squelch will only unlock if this code is being received. You can start a DCS/CTCSS scan while you are in this menu option by pressing * SCAN button
5. TxDCS - transmitter Digital-Coded Squelch, radio will send given code while transmitting
6. TxCTCS - transmitter Continuous Tone-Coded Squelch System, radio will send given code while transmitting
7. TxODir - transmitter frequency offset direction
8. TxOffs - transmitter frequency offset value

9. W/N - bandwidth used by transceiver
    - WIDE - 25kHz
    - NARROW - 12.5kHz
10. Scramb - scrambler, distorts the audio so it would be harder to understand for other listeners, if two radios use the same setting they can communicate
11. BusyCL - busy channel lockout, blocks radio from transmitting because signal is being received (with **BUSY** on screen while PTT is pressed)
12. Compnd - compander (compressor/expander), allows signals with a large dynamic range to be transmitted over facilities that have a smaller dynamic range capability, improves audio quality, both radios should use this option
13. Demodu - demodulator mode, default is FM, AM/USB can be used for listening only
14. ScAdd1 - add channel to scan list 1
15. ScAdd2 - add channel to scan list 2
16. ChSave - save current setting to a memory channel
17. ChDele - delete memory channel
18. ChName - modify memory channel name
    - Use up/down keys to select a channel to edit
    - Press the Menu button again to enter edit name mode
    - Use up/down keys or digits (0 ~ 9) to cycle the letters etc.
    - Press the Menu button to move to the next character position
    - Repeat above two steps till you reach the end
    - When "Sure?" pops up, press Menu to save, or Exit to cancel
    - Press Exit at any time to cancel the edit and return to main menu.
19. SList - selects which channel is used by memory channel scanner
20. SList1 - channels assigned to scan list 1
21. SList2 - channels assigned to scan list 2
22. ScnRev - scan resume mode
    - CARRIER - resume scan after signal disappears
    - TIMEOUT - resume scan after 5 seconds pause

    - STOP - after receiving a signal, stop the scan

23. F1Shrt - side button 1 short press function
24. F1Long - side button 1 long press function
25. F2Shrt - side button 2 short press function
26. F2Long - side button 2 long press function
27. M Long - menu button long press function
28. KeyLck - auto keypad lock option
29. TxTOut - max transmission time limit
30. BatSav - battery save option, the rate between active time and sleep time (OFF/1:1/1:2/1:3/1:4)
31. Mic - microphone sensitivity (+1.1dB .. +15.1dB)
32. MicBar - microphone bar that appears while transmitting
33. ChDisp - channel display style (Name + Freq or Number)
34. POnMsg - power on message
35. BatTxt - additional battery value on the status bar in % or V(oltage)
36. BackLt - backlight duration (OFF/ON/configured Time)
37. BLMin - minimal backlight brightness, when the screen backlight turns OFF it will go dim to this value
38. BLMax - maximal backlight brightness, when the screen backlight turns ON it will turn bright to this value
39. BltTRX - backlight activation on TX or RX
40. Beep - keypad press beep sound
41. Roger - roger beep at the end of transmission (OFF/ROGER/MDC1200)
42. STE - squelch tail eliminator, eliminates noise at the end of a transmission
43. RP STE - repeater squelch tail eliminator
44. 1 Call - one key call channel, lets you quickly switch to the channel with 9 Call button
45. ANI ID - DTMF communication radio ID
46. UPCode - DTMF code that is sent at the beginning of transmission
47. DWCode - DTMF code that is sent at the end of a transmission

48. PTT ID - sets if UPCode and/or DWCode should be transmitted
49. D ST - DTMF side tone switch, lets you hear transmitted tones in the radio speaker
50. D Resp - DTMF decoding response
    - DO NOTHING: do nothing
    - RING - Local ringing
    - REPLY - reply response
    - BOTH - local ringing + reply response
51. D Hold - DTMF auto reset time
52. D Prel - DTMF pre-load time
53. D Decd - enables DTMF decoder
54. D List - list of DTMF contacts
55. D Live - displays DTMF codes received by radio in the middle of the screen
56. AM Fix - activates autogain AM fix function
57. VOX - voice TX activation sensitivity level VOX Setting (OFF/1 .. 10)
58. BatVol - battery voltage and percentage
59. RxMode - sets how the upper and lower frequency is used
    - MAIN ONLY - always transmits and listens on the main frequency (NO extra characters on screen)
    - DUAL RX RESPOND - listens to both frequencies, if signal is received on the secondary frequency it locks to it for a couple of seconds so you can respond to the call (**DWR** on screen)
    - CROSS BAND - always transmits on the MAIN/primary and listens on the secondary frequency (**XB** on screen)
    - MAIN TX DUAL RX - always transmits on the primary, listens to both (**DW** on screen)

    Explanation of how these modes function

- The main channel is marked ► and with PTT active ►TX
- A receiving channel is marked RX as soon as a signal is received. Other VFO/channel is blocked from RX.
- With DUAL RX RESPOND, the secondary VFO/channel is marked > as temporarily the main channel when something is received there.

- If nothing is received after a timer of 4 seconds (>< on screen), that status will expire.

60. Sql - squelch sensitivity level (0=OFF/1 .. 9)

    Hidden menu

    Hidden menu is activated by holding PTT + SIDE BUTTON 1 while turning on the radio and than Release All Keys.

    The number in front of the menu-item-description is an ***menu item number*** that can be used for quick selection.

61. F Lock - sets the TX frequency band plan.
    - DEFAULT+ (137-174, 400-470) - allows TX on default bands, plus options Tx 200, Tx 350, Tx 500
    - FCC HAM (144-148, 420-450)
    - CE HAM (144-146, 430-440)
    - GB HAM (144-148, 430-440)
    - (137-174, 400-430)
    - (137-174, 400-438)
    - DISABLE ALL - disables TX on all frequencies
    - UNLOCK ALL - enables TX on all bands (it has additional lock, read a wiki on how to turn that on)
62. Tx 200 - enables TX on 200MHz
63. Tx 350 - enables TX on 350MHz
64. Tx 500 - enables TX on 500MHz
65. 350 En - enables RX on 350MHz
66. ScraEn - enables scrambler function
67. BatCal - battery calibration, measure the voltage on the back of the radio, and adjust the value in the menu accordingly
68. BatTyp - battery type, 1600mAh and 2200mAh battery has very different discharge curve, this is used to calculate battery level percentage
69. Reset - resets radio configuration settings
    - VFO - removes only channel settings
    - ALL - resets all radio settings

Button Functions

Buttons have functions assigned to them, these functions can be activated by either pressing F # button first, then the function button (I will call it F+ call). The other method is by long pressing the function button alone without F #. Most buttons replicate the F+ with long press, but some buttons might have assigned different functions for F+ and long press.

Front keypad

M

- short press - enter menu
- short press while channel/frequency scanning - last found channel is preserved on the screen
- long press - user programmable in the menu: M Long

EXIT

- short press - exits current menu/function, deletes one digit in an input box
- long press - deletes all input, exits DTMF input box, exits monitor mode

UP/DOWN

- Move Upward/Downward in Menu, Frequency, Settings, etc.

1 BAND

- F+
    - in **frequency mode** - switches frequency bands 1-7, there is also band 7+ for >1GHz frequencies
    - in **channel mode** - channel settings are copied to frequency mode
- long press - same

2 A/B

- F+ - switches main VFO upper/lower (marked by ►)
- long press - same

3 VFO/MR

- F+ - switch between frequency and channel mode
- long press - same

4 FC

- F+ - turns on frequency and CTCSS copy mode, turn the scan on and start transmitting with the other radio, the frequency and CTCSS code will be detected, you can save those setting with M button
- long press - same

5 NOAA

- F+ - turns on spectrum analyzer
- long press
    - in **channel mode** - toggles scan lists that the selected channel is assigned to. You will see I and II symbols changing on the right side of the channel label
    - in **frequency mode** - activates scan range function

6 H/M/L

- F+ - toggles power levels for current channel
- long press - same

7 VOX

- F+ - turns on/off VOX mode
- long press - same

8 R

- F+ - turns on reverse mode for channel that have frequency offset set. It will replace TX frequency with RX frequency.
- long press - same

9 Call

- F+ - switches current channel to the 1-Call channel set in the radio.
- long press - same

0 FM

- F+ - turns on FM radio
- long press - same

*** SCAN**

- short press - enters DTMF input mode
- F+ - turns on CTCSS scanner for current frequency

- long press
    - in **channel mode** - turns on channel scanner
    - in **frequency mode** - turns on frequency scanner (can use scan range feature).
- When pressed while channel scan is in progress toggles scan lists 1/2/ALL

F # ⍰

- short press - toggles function option
- long press - turns on/off key lock all the keys of the Front keypad

Side buttons

PTT

- Push To Talk button.
- when this button is used to stop channel/frequency scanning, last found channel is preserved on the screen
- held together with Function button II transmits tone 1750Hz
- held together with any of the front keypad buttons transmits DTMF codes

Function button I

- short press - user programmable in the menu: F1Shrt
- long press - user programmable in the menu: F1Long

Function button II

- short press - user programmable in the menu: F2Shrt
- long press - user programmable in the menu: F2Long
- this button can also be used to send tone 1750Hz by holding it together with PTT button

External key/microphone

PTT

- Push To Talk button.
- The PTT on the external microphone works differently than the internal PTT (side) button.
-
    - When pressing the PTT, the TX waits until no RX signal is received (*observed with Radio-PCB revision V1.4 and OK with V1.6*). Works well when pressing the *internal PTT*.

-
    - A DTMF-tone (key-press) or 1750Hz-tone (function button) is cut off within a second. Works well when pressing the *internal PTT*.

Custom button functions

3 buttons can have its function changed. To change the function go to menu:

- F1Shrt - side button 1, short press
- F1Long - side button 2, long press
- F2Shrt - side button 1, short press
- F2Long - side button 2, long press
- M Long - menu button, long press

Available functions:

- NONE - no action
- FLASH LIGHT - switch to the next flashlight function: on / flash / SOS / off
- POWER - switch radio output power: L (low) / M (medium) / H (high)
- MONITOR - switch monitor mode on/off
- SCAN - start channels/frequency scanning
- VOX - turn voice activation function on/off
- FM RADIO - turn FM radio on/off
- LOCK KEYPAD - lock/unlock the keypad
- SWITCH VFO - change main VFO to upper/lower
- VFO/MR - change current VFO mode, frequency mode or channel mode
- SWITCH DEMODUL - switch to the next demodulation mode (FM/AM/USB)

Spectrum Sweep screen

Press F + 5 NOAA to turn on the **Spectrum analyzer**.

The current VFO/Memory frequency is the ***start frequency*** of the spectrum sweep

Button functions

- 1 / 7 - increases/decreases the channel separation of a single bar in the graph
- 4 - changes the number of channels to scan and toggles the number of bars in the graph
- 2 / 8 - increases/decreases frequency step size
- 5 - shows a frequency input box for lower sweep frequency. (value in **MHz**, * - decimal point)
- 3 / 9 - increases/decreases maximum dB value (vertical scale)
- 6 - toggles receiver bandwidth
- * / F - increases/decreases squelch level
- 0 - toggles modulation type (FM/AM/USB)
- Side Button I - excludes current frequency from the spectrum scan
- Side Button II - toggles backlight
- EXIT - exits to a previous screen/function
- PTT - switches screen to ***detail monitoring*** of last received frequency (*see below*)

Button functions

- M - Scrolls through the parameters displayed at the bottom of the screen which can be adjusted with UP/DOWN
    - LNAs - Short Low Noise Amplifier
    - LNA - Low Noise Amplifier
    - PGA - Programmable Gain Amplifier
    - IF - Intermediate Frequency
- EXIT - exits to the previous screen of the spectrum analyzer

Flashing firmware is possible with a separate program, but can now be done much more easily from your web browser.

Just goto the page with official released egzumer firmware releases.

- Use a Baofeng/Kenwood-like USB-2-Serial-cable and connect it to your computer.
- Switch off UV-K5
- Put the UV-K5 into programming mode (press and hold the PTT button and turn on the UV-K5, check that the flashlight lights up).
- Then press the programming cable *firmly* into the radio
- Select the latest/desired firmware and look for FLASH WITH A BROWSER and the build-in *UV-mod-programming-page* start. Just wait a moment and the firmware is loaded, or select a different file from your PC.
- Press flash firmware and a screen pops-up.
- Select the Com-port where the programming-interface is connected.
- Press Connect and the firmware programming starts (White LED starts flashing) and view the progress in the browser-screen
- Just wait ... until

When finished, disconnect the programming interface and *enjoy a new release version* ;-)

Not all original features are available in this firmware.

Because the size of the firmware is limited (60kB), not all functionalities may be available in the firmware. That is why a choice was made so that other functionality could be realized in the radio. The menu has also been adjusted as a result. See Menu for a current description.

The most important differences compared to the original firmware are:

ENABLE_AIRCOPY := 0

ENABLE_NOAA := 0

ENABLE_VOICE := 0

ENABLE_ALARM := 0

ENABLE_TX1750 := 0

ENABLE_PWRON_PASSWORD := 0

If you want to change something here, read the **README.md** under User customization on the Wiki page.