

# UXFFront Operation Manual (HW revision A, SW V1.0+)

Joe Haas, KE0FF  
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joeh-at-ke0ff-dot-org

The UXFFront PCBA is a replacement board for the ICOM IC-900/901 UX radio modules “Front Unit” that allows the module to run as a (nearly) stand-alone transceiver. Audio processing circuits for MOD and DET audio may be needed for some applications, but the basic radio functions are handled on-board (*Note: See Appendix A for instructions on modifying the PCBA to allow de-emphasis*). It utilizes an SiLabs C8051F530 microcontroller to control the radio functions and provides a “flat” audio interface for the MOD and DET signals. Squelch can be controlled by a logic input to have either 2 or 8 settings, depending on the mode selected. DET output level is “flat” (no de-emphasis) and is programmable in 255 steps over a range of near zero to as much as 1.6 Vpp (560 mVrms) with a 1KHz tone modulated at 5KHz deviation on the receive frequency.

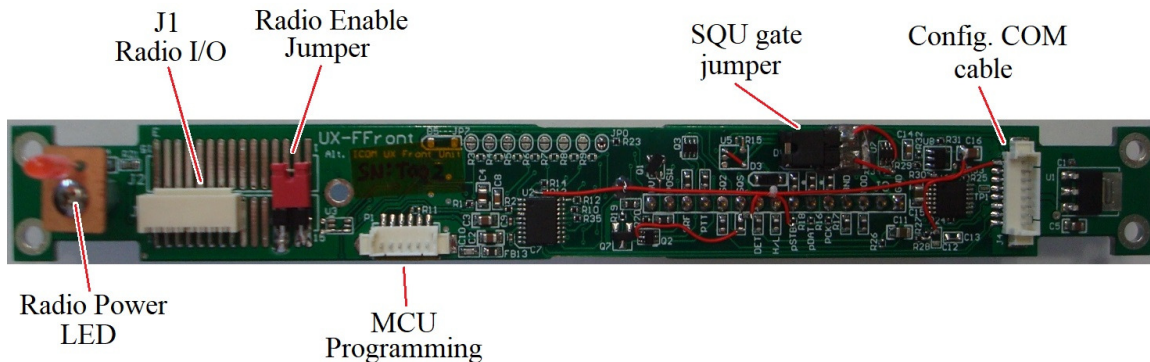


Figure 1. UXFFront PCBA

## Installation

The UXFFront PCBA replaces the existing “front” control board of the UX radio module. An optional 3D-printed replacement cover features a DB-9 (male) connector with a short cable to connect to the UXFFront PCBA at J1. Make sure the power cable for the UX module is removed or the power supply is confirmed to be off and discharged. The first step is to remove the existing front cover of the module by gently rocking it along its long axis until it can be separated from the chassis. Next, remove the 4 screws at the corners of the existing PCBA (retain the screws).



Figure 2. Paper-clip PCBA extraction tool. The gap should measure approximately 3/4”.

The ICOM boards are relatively thin, so some care must be exercised in their removal. A heavy-duty paper clip that has been straightened and then formed into a “U” shape can greatly aid in the removal. Bend small “L” hooks at the ends of the “U” to allow the clip to hook under the bottom surface of the PCB for removal (see Figure 2 for an example). Work the hooks to approximately the center of the 15-pin connector that extends into the radio housing. Once removed, be sure to safely secure the ICOM PCBA and store it for later retrieval.

Carefully line-up the 15 pin connector of the UXFFront PCBA with the radio connector and insert until the PCB “just” makes contact with the chassis mounting bosses. Make sure that the corner holes all line up properly and re-install the 4 screws removed earlier. *Note: At this point, one will generally wish to configure the module. If this is the case, follow the steps in the “Configuration” section before completing the installation.*

There are two options for the radio interface cable that attaches to J1 on the UXFFront PCBA. The first option has a DB-9 connector (see pinout below). The second option provides “flying leads” that the user may attach to the connector of their choice. For whichever option is chosen, complete the connections to the target system (repeater controller or other interface). At a minimum, one would need to connect MOD, PTT, DET, and GND to the target system. COS, SQUEL, and SRF are options that can be exercised if required.

Install the radio interface cable (an 8-position, 1.5mm connector) at J1, make sure the J1 header jumper is installed, and make sure the DET gate jumper is removed (no squelch gate) or installed (DET audio gated when the squelch is closed) as desired. Finally, attach the radio cover. Make sure that the radio interface cable wires don’t get pinched as the cover is attached.

# Operation

The UXFFront PCBA receives power from the UX module. +5V is available on J1 for powering small loads (less than 20mA). *Note: Do not supply external power to this connection!* In addition to the power and GND pins, the radio interface provides MOD and DET audio connections, PTT (ground = TX), COS (ground = squelch open), and a squelch select input (GND or OPEN) that is used to control the squelch setting from an external controller or switch. SRF is also available to indicate TX operation or receive signal strength.

## Radio:

### J1 & DB-9 Pinout

	GND	1	2	+5V out	(20mA, max)
(AC coupled)	MOD in	3	4	PTT in	(GND to TX, OPEN to RX)
	SQUEL in	5	6	DET out	(AC coupled)
(GND = open squelch)	COS out	7	8	SRF out	(approx 1.45V, full scale)
	(DB-9 only) n/c	9			

*SQUEL input: GND = SQUA setting, OPEN = SQU setting*  
*MOD level: A 1KHz, 130 mVrms tone will produce 5 KHz deviation*  
*(20 mVrms for 750 Hz deviation) at the TX frequency. Note that these values*  
*are affected by the deviation control inside the UX module.*  
*DET level: with VOL = 255, a 1 KHz tone at 5 KHz deviation on the RX frequency*  
*will produce approximately 560 mVrms (1.6 Vpp) at the DET output.*

The default squelch mode is the 2-step mode. In this mode SQUELSEL determines the squelch setting based on the state of the SQUELSEL input & the settings for SQU & SQUA. This allows an external logic signal to control the squelch setting with 2 available levels. For more control, the 8-step mode can be enabled to allow a range of 8 squelch settings to be controlled by SQUELSEL.

In 8-step mode, the system treats SQUELSEL as a pulse input. The squelch starts at the SQU setting and each time SQUELSEL goes low (for at least 50ms), the value for SQUA is added to the current squelch setting. At the 8<sup>th</sup> pulse, the setting is reset to the SQU value and the process repeats. If SQUELSEL is held low for more than 0.5 seconds, the squelch setting is reset to the SQU value and the process repeats.

The “X” command in configux.exe is used to control the step-mode. “X1” sets the 8-step mode and “X0” sets the 2-step mode. While in 8-step mode and if  $SQUA * 8 > 225$ , the configux.exe program will flag the error by displaying the SQUA field in red. Generally, the value of SQUA should be about 5 or less for the 8-step mode.

## Configuration

While the UXFFront system can be configured with nothing more than a PC terminal emulator (requires a COM port be available on the PC – any valid COM interface should work), it is recommended that the “configux.exe” console application be used as this greatly simplifies the configuration process. This application is available at “<https://www.github.com/ke0ff/UXFFconfigurator>”. For those who wish to communicate directly with the UXFFront with a custom PC or embedded application, refer to Appendix B: Bare-Metal Serial Commands.

The configuration connection is depicted below. This connector is intended to attach to an RS-232 adapter PCBA which features a DB-9 connector that can mate with a standard PC COM port (see Figure 3). J4 may also directly connect to an external controller that provides a TTL level (5V logic) serial interface to allow real-time control of the radio settings (connection length should be less than 12” for TTL control).

Configuration connector:	<u>J4 Pinout</u>	
RADIO->PC	1	TTL (5V logic) serial
PC->RADIO	2	TTL (5V logic) serial
GND	3	
+5V out	4	40 mA, max
n/c	5	
n/c	6	
n/c	7	
n/c	8	

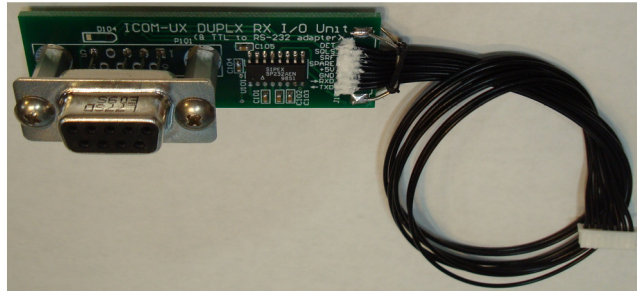


Figure 3. UXFFront Config serial adapter cable.

For testing purposes during configuration, it is recommended that an audio source for the transmitter and an amplified speaker for monitoring the receive audio be connected to the radio interface cable. A switch for activating PTT, and another for the SQUEL input are also recommended. Finally, an LED or some other means to indicate that COS is active should be available. Ideally, these test resources would be provided by the actual interface device to be used which is the best way to assure that the configuration settings will be correct.

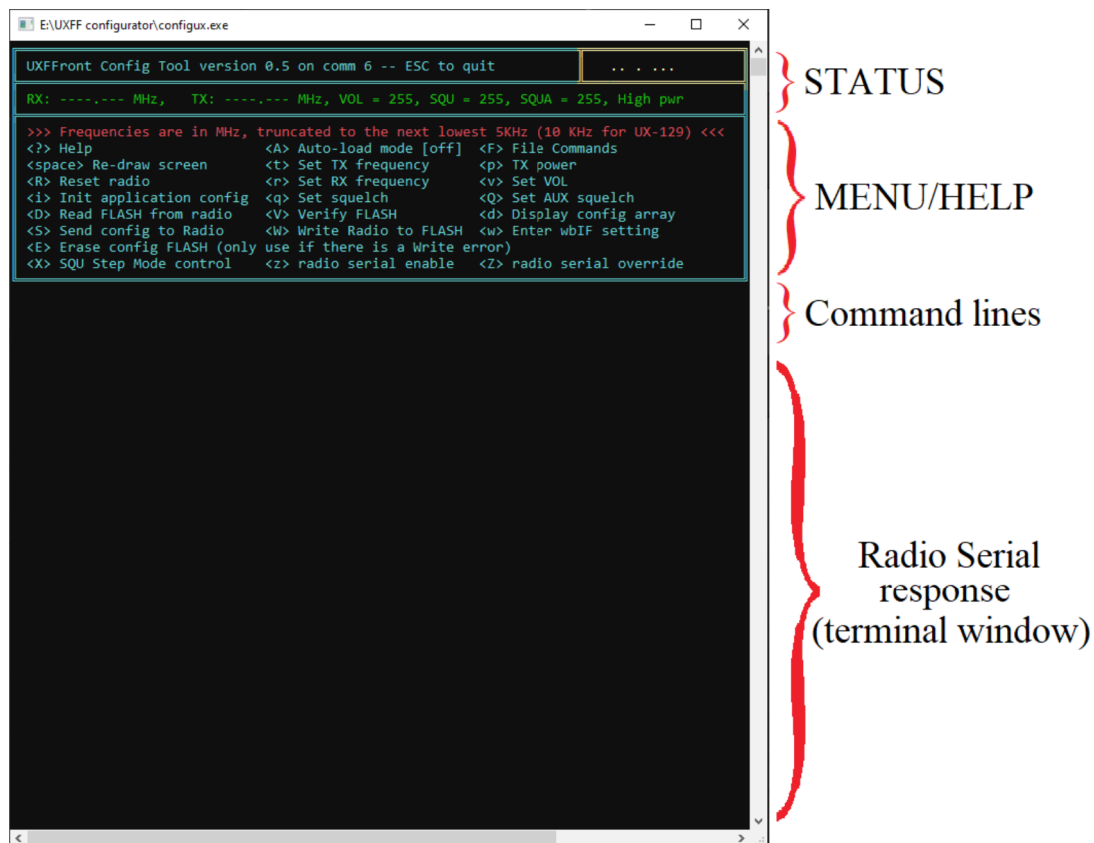


Figure 4. configur.exe console window.

The configux.exe application features an extensive help list that is accessible from within the application. The radio processor stores 10 words (32 bits) of PLL data (5 for RX and 5 for TX frequencies) plus 1 word for the remaining settings (Squelch, SQU; Aux. Squelch, SQUA; Audio Level, VOL; TX power level, High or Low; wide-band IF select; and squelch mode, 2 or 8-step). The configux.exe program calculates the PLL values based on the frequency input from the user and pre-places any module-specific PLL config words needed. Once all of these parameters are configured and verified correct on the radio, they may be stored to the Radio's FLASH memory so that they can be restored when the radio powers up. At this point, the PC is no longer required for the radio to operate.

The configux.exe commands are single-character key-presses, some of which require additional input keystrokes. Commands are case sensitive, so the command executed by "z" is different than the command executed by "Z". There are 4 basic sections to the application window (refer to Figure 4). The first is near the top where the radio and configux status is displayed. Next is the command help list. This is a list of most of the commands that are available. There are a few debug commands and commands relating to the UX-129 support that are not displayed. The two lines below the command list are the 3<sup>rd</sup> area which is where the command responses and prompts are displayed. Lastly, the bottom area of the window is dedicated largely to the display of serial responses from the radio.

The upper right corner of the status field is an area where the real-time radio status is indicated. This area shows if the radio is in RX or TX mode, the state of the SRF signal, and the state of COS (both COS and a "sticky" COS indicator are provided). This area also indicates when the radio data is stale, or the RF section is "OFF" based on the characters displayed. The following describes the indications:

.. . . .	RX data is stale (no radio power, radio disconnected, or the radio status is disabled). The radio outputs status data whenever the SRF value changes, or approximately one second after the last status message. This algorithm ensures "instant" data updates and also minimizes the serial traffic on the RS-232 bus. If configux.exe doesn't see a status message within the timeout window (about 2 sec), this data format is displayed indicating that the radio is not sending any status messages.
rx c srf *	'rx' indicates PTT is inactive, so the module is receiving. 'c' is the COS status, 0 = squelch closed, 1 = open. 'srf' is the rssi, 000 = no signal, typ. max is between 80 – 100 & this will vary somewhat from one module to another. '*' is a 'sticky' COS indicator that activates when COS is detected, but remains active for about 3 sec after COS goes inactive.
TX - srf	'TX' indicates PTT is active, so the module is transmitting. '-' there is nothing to report in this space for TX. 'srf' is the rf valid signal, <10 indicates RF failure, typ. value is about 50 regardless of the actual module transmitting power level.
RX X XXX	This indicates that there is no valid data stored in the radio and the RF circuits are off (the LED indicator will also be off). However, the MCU is still sending regular status data and will still respond to commands.

The radio-enable jumper (next to J1 on the PCBA) is important during configuration. Removing this jumper before applying power inhibits the radio power from being activated, this should be done any

time the UXFFront is installed on a new UX module as the PLL data from one frequency band is not compatible with the PLL system of other frequency bands. All of the radio command functions are still available, but the radio cannot be turned on with this jumper removed. Once the receive frequency has been properly entered, the jumper can be replaced (then issue the “k” command to “wake up” the radio). The remaining parameters can then be entered and stored as appropriate.

The user may also save (and then re-load) configuration data to/from a disk file using the “F” file command. This can save time when setting up a new module and allow the settings to be archived for future reference.

The following is a sample list of the commands needed to completely configure the UXFFront PCBA:

{Remove the jumper near J1, connect the configuration serial adapter, start “configux.exe” on the host PC, apply power to the UX module, then enter the following commands}

{verify that the “.. . .” status message is NOT displayed. Enter “z1” to enable serial status. If this does not produce valid status, troubleshoot the issue before continuing}

- “r” Enter the RX frequency. Be sure that the frequency is within the limits of the band module. For the 6m and 2m modules, the wbIF mode will automatically set if the frequency is outside the ham-band limits.
- “t” Enter the TX frequency. If the frequency is outside the limits for the band selected by “r”, an error will occur. Always enter a valid TX frequency even for RX-only applications.
- “w” If desired, the wbIF setting can be overridden (enabled for in-band, or disabled for out-of-band frequencies). Use this command to enable or disable the wide-band IF.
- {Replace the jumper near J1 and press “k” on the PC application to restart the radio}
- “p” Set high (“1”) or low (“0”) TX power.
- “v” Enter the RX volume level. For fixed systems, such as a repeater installation, this should be adjusted to match the input level requirements of the system. For systems with an external volume control, set this value to the maximum level possible (up to 255).
- “q” Enter the primary squelch setting. Values of 25 – 50 are generally the range where the squelch threshold will exist for no additive input noise to the radio antenna connector. However, this will vary from module to module and will also be influenced by the RF environment experienced at the final installation point.
- “Q” Enter the auxiliary squelch setting. For 2-step configurations, set SQUA to something like SQU + 15 as a starting point. For 8-step mode, start with this setting at about 3. If neither mode is to be implemented, set SQUA = SQU.
- {Repeat the settings for “v”, “q”, and “Q” as needed to get the values needed for the best system performance.}
- {Once all of the settings are as desired, continue here:}
- “W” Write the current radio configuration to FLASH memory in the radio processor.
- “V” Verify the FLASH store was correct.
- “F” Save the file to the PC’s disk drive (default destination is the folder containing the configux.exe application).

The radio is now configured and ready for use. Remove power from the UX module, remove the serial adapter, and complete the installation.

## configux.exe command details

All commands used with configux.exe are single characters and execute when the corresponding key is pressed while Windows is focused on the configux console window. Commands that require an additional single character parameter will be ready to accept that character immediately after the command character is detected (no <Enter> key required). Commands that can accept more than one parameter character (such as the “v” VOL command) require “Enter” (or “Return” on some keyboards) after the parameter characters are entered.

There are several options for running the program. Either execute it directly from Windows, or a command prompt, or by using a batch file. The batch file is the most flexible as this allows the command line arguments to be easily manipulated. There is also a line of code that the batch file can execute to list the available COM ports on the system (see “configrun.bat” available in the github repo). This saves the trouble of having to open the device manager in Windows and look up the current COM ports.

There is also a “.ini” file mechanism for retaining some of the settings for the program (configux.ini). This file is another way to customize the operating environment of the utility.

The following command line options are available when running configux.exe. These arguments are entered on the same line as “configux.exe” (or inside a batch file) with each item separated by a space:

C {comm port}	Selects the COM port to use. If invalid, the user will be prompted once for another choice.
A	Enable auto-load of current radio configuration (defaults to off)
I	Enables ini file creation on exit
B {baud rate}	Set Baud rate (default is 9600). This option is to support future hardware. It currently should always be set to 9600, or left at the default.
Q	Quick start – jumps to main menu if COM port is valid skipping the startup messages and prompts. If the COM port is invalid, the user is prompted once for a 2 <sup>nd</sup> choice.
?	Usage help. Produces this list at startup.

The following list details the commands available when running configux.exe.

### **? : List Command Help**

Displays a detailed, multi-page help file.

### **~ : List Command Help to disk**

Displays a detailed, multi-page help file and saves the displayed text to “configux.hlp” in the current folder. The operator must “page-through” the entire help-list to complete the save operation.

**<space bar>: Re-draw application screen**

Clears display and re-draws the screen.

**i: Initialize configuration memory**

Clears all radio parameters in the PC configuration memory – does not affect Radio settings.

**D: Download configuration memory from Radio FLASH**

Transfers all radio parameters from the radio FLASH memory to the PC configuration memory. This will over-write any settings previously entered by the user.

**A: Auto-load toggle**

When first starting the configux.exe application, or when the application detects a radio reset, the “auto-load” mode will cause the application to automatically load the radio configuration into the PC configuration memory. The “A” command toggles the state of the auto-load mode (on or off).

**k: “kick” PLL**

Causes the radio to send the PLL data in its internal memory to the PLL system. This, in turn, will cause the radio to power on if the J1 jumper is installed and the radio power is off.

**S: Send config data to radio**

Forces a transfer of all parameters from the PC to the radio RAM.

**F: Enter PC file mode**

Prompts user to enter “L” for load or “S” for save. The user then enters a filename with or without a file-type extension. If no extension is detected, “.txt” is automatically appended to the filename. To simplify filename entry, files should be located within the same PC folder as the configux.exe application (this is the default folder). Otherwise, the full path for the file must be entered (there is an 80 character limit for the path plus filename). If there is a file error, a message will appear and the file mode will be aborted.

**W: Write radio RAM config to FLASH**

Prompts the user: "Erase FLASH, press Y to accept..." and waits for input. Any character other than "Y" or "y" will cause this command to abort with no changes to the system. If an error message appears in the serial window, execute the “E” command to erase the FLASH data area.

**E: Erase FLASH**

Prompts the user: "Erase FLASH, press Y to accept..." and waits for input. Any character other than "Y" or "y" will cause this command to abort with no changes to the system. This command must be executed if the “W” command results in a “full” error in the serial terminal window. This command should only be required when a “full” error is displayed in the terminal area in response to a “W” command.

**V: Verify FLASH**

Verifies the data in the radio FLASH against that in the PC memory.



**R: Reset radio system**

Prompts the user: "Reset radio, press Y to accept..." and waits 5 sec for input. Any character other than "Y" or "y" will cause this command to abort with no changes to the system. Otherwise, the radio will execute a warm-reset.

**r: RX frequency enter****t: TX frequency enter**

Prompts operator for a frequency (in MHz) for RX or TX. The RX frequency must be set first if the config data is initialized or when changing to a new frequency band. If the change is to a new frequency band, the TX frequency will be cleared. Frequencies are rounded down to the next 5 KHz (10KHz for the UX-129 module).

For RX frequencies outside the "Ham" band limits on 6m and 2m (50-53.995 MHz and 144-147.995 MHz), the wbIF mode is automatically set. This is indicated in the status area of the screen. To manually override this setting, enter the "w" command after entering the RX frequency.

The frequency ranges are assigned to a particular UX band module as follows:

UX19: 20 to 39.995 MHz

UX59: 40 to 60 MHz (wideband IF outside 50-53.995 MHz)

UX29: 120 to 170 MHz (wideband IF outside 144-147.995 MHz)

UX39: 220 to 225 MHz

UX49: 400 to 455 MHz

UX129: 1200 to 1320 MHz

**w: Wide-Band IF setting**

Prompts user to enter "1" to enable wbIF, or "0" to disable. This setting only has effect for the UX-59 (6m) and UX-29 (2m) modules.

**p: Set TX power**

Prompts user to enter power level, 0 = low, 1 = high. Press <Enter> to abort.

**v: Set radio volume**

Prompts the user to enter the volume setting (0-255). The DET output will be linearly controlled by this setting. When receiving a 1KHz tone at 4KHz deviation with VOL = 255, the output will be approximately 323mVrms on a module that has been aligned per the IC-900 service manual. For other settings, the output will be  $323 * VOL/255$  (mVrms).

**q: Set primary squelch**

Prompts the user to enter the primary squelch setting (0-255). This is the squelch setting that is used when SQUEL = 1 (open) for the 2-step mode. It is also the initial setting for the 8-step mode.

**Q: Set secondary squelch**

Prompts the user to enter the secondary squelch setting (0-255). This is the squelch setting that is used when SQUEL = 0 (GND) for the 2-step mode. It is also the delta value that is added to the current squelch setting when SQUEL pulses while in the 8-step mode.

**X: Set squelch mode**

Prompts the user to enter the volume squelch step mode. 1 = 8-step, 0 = 2-step.

**z: Radio serial status enable**

Prompts the user to enter the status mode of the radio. 1 = enable, 0 = disable. When power is applied to the radio, the default state is for no status information to be broadcast. This simplifies bare-metal configuration and also reduces the possibility of EMI.

The configx.exe application will automatically enable the serial status mode when it detects a radio reset message. However, there are times when this might not be properly recognized. If the user expects there to be radio status updates, this command should be used to verify that the radio is functioning properly.

**Z: Set serial status override**

Prompts the user to enter the serial override mode. 1 = override (force serial status on power-up), 0 = normal (no serial status on power-up). This mode is saved with the “W” FLASH store command and allows the radio to automatically send status messages when powered on.

## UX-129 (1200 MHz) Module-Specific Commands

The UX-129 features an RIT/XIT mode that allows the operating frequency to be adjusted (trimmed) between the normal 10KHz channel spacing. The adjustment range is +7 or -8 “steps” where the steps are approximately 1.25KHz. The following commands allow these steps to be encoded into the FLASH data and be executed when the UX-129 PLL data is updated. These commands are only accessible if there is a UX-129 frequency selected in the current configuration (1200 to 1320 MHz). *Note: When a new RX or TX frequency is entered, the trimming offset is cleared and must be re-entered if needed.*

**<ctrl-T>: Set TX (XIT) adjust mode**

Sets the focus of the adjustments to the TX frequency setting. Displays “UX-129 XIT” in the command line area of the screen.

**<ctrl-R>: Set RX (RIT) adjust mode**

Sets the focus of the adjustments to the RX frequency setting. Displays “UX-129 rit” in the command line area of the screen.

**-: set negative step value****+: set positive step value**

Prompts for entry of the desired step value. Values of 0-9 are accepted but values greater than 7 (+) or 8 (-) will not generate desired results.

## Debug Commands

The following commands are intended for debug purposes. They are not generally required but are included here for completeness.

### **B: set serial baud rate**

This is for possible future modifications to the UXFF system. Currently, the only valid baud rate is 9600.

### **d: display PC configuration array (in hex)**

Displays the list of 11, 32-bit data words that comprise the radio configuration data which resides in the PC.

### **s: display Radio configuration array (in hex)**

Displays the list of 11, 32-bit data words that comprise the RAM radio configuration data which resides in the radio.

### **P: Manual entry of config word (in hex)**

Allows the user to manually enter each 32-bit word of the PC configuration array.

## Appendix A

### De-emphasis modification

The UXFFront PCBA features component locations that support a simple de-emphasis circuit. R27, R28, C12, and C13 are used to form the de-emphasis network. These components are populated so that there is no de-emphasis in the DET audio path. In order to enable de-emphasis, these components need to be removed and replaced. *Note: This process requires SMT soldering skills with 0402 size components or larger.*

To modify the PCBA, First, obtain the following components:

<u>QTY</u>	<u>REFDES</u>	<u>Value</u>	<u>Description</u>	<u>MFR P/N</u>	<u>MFR</u>
1	R27	4.7K	RES, FLM, THK, 0402, 4.7K, 1%	RC0402FR-074K7L	Yageo
1	R28	47K	RES, FLM, THK, 0402, 47K, 1%	RC0402FR-0747KL	Yageo
1	R30	10K	RES, FLM, THK, 0402, 10K, 1%	RC0402FR-0710KL	Yageo
1	C(R30)	220pF	CAP, MLCC, 0402, 0.22uF, 25V	VJ0402A221FXXCW1BC	Vishay
1	C12	0.22uF	CAP, MLCC, 0603, 0.22uF, 25V	885012206073	Würth
1	C13	0.1uF	CAP, MLCC, 0603, 0.1uF, 25V	CC0603JRX7R7BB104	Yageo

The requirements for the components are contained in the description. Use the information there to find substitutes as necessary. Remove the components or jumper-wires at R27, R28, C12, and C13. In addition, remove the resistor and capacitor located at R30. Discard the removed items. Replace the removed components with those listed above. For R30, place the resistor and solder both sides, then place the 220pF capacitor directly on top of the 10K resistor and solder both ends. A short piece of AWG30 wire-wrap wire needs to be attached between the grounded end of R28 and the adjacent pad for C12. The two pads are furthest from the edge of the PCB. Carefully inspect the soldering and correct any issues. Re-install the PCB in the radio module.

With the de-emphasis circuit installed, the DET audio output will be lower than with the “flat” circuit. With a 1 KHz tone modulating at 5 KHz deviation on the receive frequency, the DET output will be about 74 mVrms (209mVpp) with the VOL set to 255.

## Appendix B

### Bare-Metal Serial Commands

The radio serial connection works much the same as the configux.exe application. The main difference is that the radio does not prompt for data and the command characters are not all the same as those used by configux.exe. The target serial port is fixed at 9600 baud, N81 and all commands are terminated with <CR> (ASCII 0x0d, <ENTER> or <RETURN> on most keyboards). *Note: the serial port does not echo characters as they are entered.*

Commands are 1 to 11 ASCII characters, (the “command” characters are case sensitive while the remaining parameters are not).

The following list features the command character (two characters in the case of the “EA” command) followed by “hh”, “n”, or “ll” for hex data, or “dd” for decimal data. *Note: The prefix “0x” is placed before hex numbers in this document.* For example, “bhh” would be sent as “b00<cr>” or “ba5<cr>” where the data to be programmed was 0x00 or 0xA5.

#### **?: List Command Help**

Displays an abbreviated list of the available commands.

#### **C: Initialize configuration memory**

Prompts the user: "Clear config, press “Y” to cont..." and waits up to 5 seconds for input. Any character other than "Y" will cause this command to abort with no changes to the system. Otherwise, clears all radio parameters in the config RAM locations. Responds with “~Complete!” if successful, or “~Abort.” otherwise.

#### **k: “kick” PLL**

Causes the radio to send the PLL data in its internal memory to the PLL system. This, in turn, will cause the radio to power on if the J1 jumper is installed and the radio power is off. Responds “~Update PLL.”

#### **F: Send raw FLASH config data to PC**

Sends the 11 words (32bit) of config data from FLASH to the serial port. The data is sent as an 8-digit ASCII hex number for each of the 11 FLASH words. Each word is terminated by a CR/LF.

#### **f: Send raw RAM config data to PC**

Sends the 11 words (32bit) of config data from RAM to the serial port. The data is sent as an 8-digit ASCII hex number for each of the 11 RAM words. Each word is terminated by a CR/LF.

#### **p: Set raw config word**

This command sets one word of the RAM data. The format is “pnllhhhhhh”. “p” is the command character, “n” is the word number (valid from 0x0 – 0xa). “llh...h” is the 8-digit hex word (ll is the length of the PLL data for those fields that hold PLL data). All hex data is in ASCII format (not case sensitive).

### **W: Write config to FLASH**

Prompts the user: "Write FLASH, press "Y" to cont..." and waits up to 5 seconds for input. Any character other than "Y" will cause this command to abort with no changes to the system. Writes radio RAM configuration to FLASH, responds with "~Data pgmd!" if successful. If "~Error: FLASH FULL, Erase first" is sent on the serial port, one must then execute the "EA" command to erase the FLASH data area before re-trying this command. If the TX or RX PLL data is not configured, "~Error: T or R invalid" is the reply. Lastly, the message "~Error: config invalid" is sent if the band ID byte is not configured.

### **EA: Erase FLASH**

Prompts the user: "Erase FLASH, press "Y" to cont..." and waits up to 5 seconds for input. Any character other than "Y" will cause this command to abort with no changes to the system. This command must be executed if the "W" command results in a "full" error in the serial terminal window. Responses are "~Erased!" if successful, else "~Aborted".

### **V: Update VOL/SQU**

Writes the current VOL/SQU data to a new FLASH slot, keeping the frequency data from the current FLASH slot. Responds "~Data pgmd!" if OK, or "~E2: FLASH full.

### **R: Warm System Reset**

Prompts the user: "Reboot radio, press Y to cont..." and waits 5 sec for input. Any character other than "Y" will cause this command to abort with no changes to the system. Otherwise, the radio will execute a warm-reset. Responds "~REBOOTING..." or "~Aborted..".

### **bhh: Set Band ID byte**

Sets band ID and other flags. Responds "~Set BAND" or "~Error!". Band ID is in the lower 4 bits:

<u>bitmask</u>	<u>Description</u>
0x0f:	band ID (see below)
0x10:	wbIF enable
0x20:	TX = high power
0x40:	Serial status enable
0x80:	8-step squelch mode

The band ID is defined as follows:

UX19:	1
UX59:	2
UX29:	3
UX39:	4
UX49:	5
UX129:	6

### **w: Wide-Band IF setting**

Prompts user to enter "1" to enable wbIF, or "0" to disable. This setting only has effect for the UX-59 (6m) and UX-29 (2m) modules.

**mdd: Set TX power**

Prompts user to enter power level, dd = “00” sets low, dd = “01” sets high. Responds “~Set rf PWR” or “~Error!”.

**vhh: Set radio volume**

Enters setting for volume (hh = “00” – “ff”). Responds “~Set VOL” or “~Error!”.

**qhh: Set primary squelch**

Enters setting for primary squelch (hh = “00” – “ff”). Responds “~Set SQU” or “~Error!”.

**Qhh: Set secondary squelch**

Enters setting for auxilliary squelch (hh = “00” – “ff”). Responds “~Set SQUA” or “~Error!”. This is the squelch setting that is used when SQUEL = 0 (GND) for the 2-step mode. It is also the delta value that is added to the current squelch setting when SQUEL pulses while in the 8-step mode.

**X: Query Number of Steps**

Returns the number of steps used in the “step mode”. Allows changes to the multi-step system to be transferred the configux.exe program. Responds “~MAX STEPS:d..d” where “d...d” is the decimal value for the number of steps available in the “8-step” mode.

**xhh: Set multi-step mode**

“hh” = “00” for 2-step mode, or “01” for multi-step mode. Responds “~SQU Step on” (8-step mode) or “~SQU Step off” (2-step mode).

**zdd: Radio serial status enable**

Sets the serial status mode: dd = “00” disables serial status, dd = “01” enables.

The configux.exe application will automatically enable the serial status mode when it detects a radio reset message. However, there are times when this might not be properly recognized. If the user expects there to be radio status updates, this command should be used to verify that the radio is functioning properly.

Bit 6 (mask = 0x40) of the Band ID Byte forces the serial status mode enabled at power up. This bit must be set using the Set Band ID byte command (bhh) if enabling this feature at power-on is desired in bare-metal applications.

The source code for the MCU is available at “[https://www.github.com/ke0ff/ICOM\\_UXFF\\_RevT](https://www.github.com/ke0ff/ICOM_UXFF_RevT)”. Instructions for building the object code and programming the MCU are available there.

# Appendix C

## Schematic and BOM

### Bill Of Materials, UXFFront PCBA

<u>QTY</u>	<u>REFDES</u>	<u>Value</u>	<u>Description</u>	<u>MPN</u>	<u>MFR</u>
3	C1, C7, C9	0.1uF	CAP, CER, 0402, 0.1uF, 16V	CC0402JRX7R7BB104	Yageo
1	C10	1000pF	CAP, CER, 0603, 1000pF, COG, 50V	GRM1885C1H102JA01D	Murata
3	C11, C15, FB11	10uF	CAP, CHP, 0805, 10uF, 35V	GMK212BBJ106MG-T	Taiyo Yuden
1	C13	0	RES, FLM, THK, 0603, 0, 1%	RC0603FR-070RL	Yageo
1	C14	0.22uF	CAP, CHP, 0603, 0.22uF, 25V	885012206073	Wurth
3	C2, C3, C5	4.7uF	CAP, CER, 0805, 4.7uF, 10V	C2012X7R1A475M125AC	TDK
2	C4, FB25	1.0uF	CAP, CER, 0805, 1.0uF, 25V	C0805C105K3RACTU	Kemet
2	C6, C16	22uF	CAP, CER, 0805, 22uF, 25V	GRM21BR61E226ME44K	Murata
1	C8	0.1uF	CAP, CER, 0603, 0.1uF, 25V	CC0603JRX7R7BB104	Yageo
1	CT1	220pF	CAP, CHP, 0402, 0.22uF, 25V	VJ0402A221FXXCW1BC	Vishay
3	D1, D2, D3	RB168MM	DIOD, SHTKY, 1A, 40V	RB168MM-40TFTR	Rohm Semi
1	D4	LED, RED	LED, SMD, RED	HLMP-LG75-XY0DD	Broadcom
2	FB27, FB28	220 ohm	FB, SMD, 0603, 220 ohm	BLM18AG221SN1D	Murata
15	FB8, FB9, FB12, FB13, FB14, FB15, FB16, FB17, FB18, FB19, FB20, FB21, FB22, FB23, FB24	600 ohm	FB, SMD, 0603, 600 ohm	BLM18AG601SN1D	Murata
1	J1	T/R I/O	CON, SMD, 1.5mm, 8POS, VERT	87437-0843	Molex
1	J3	Radio	CON, HDR, 1ROW, 15POS, 0.1	ZW-15-10-G-S-335-339	Samtec
1	J4	Config	CON, 8POS, 1.25MM, SMD	53398-0871	Molex
1	JP0	10.0K	RES, FLM, THK, 0603, 10.0K, 1%	RC0603FR-0710KL	Yageo
2	JP1, JP2	2 POS	JUMPER, TH, 0.1"	68001-420HLF	FCI
1	P1	MCU PGM	CON, 6POS, 1.25MM, SMD	53261-0671	Molex
1	Q1	NDS355	TR, NFET, 30V, 0.85A, SOT-23	NDS355	Fairchild Semi
2	Q2, Q3	FDG6301N	TR, NFET, 30V, 0.85A, DCK-6	FDG6301N_F085	Fairchild Semi
1	Q7	MMBFJ176	TR, JFET, 30V, SOT23	MMBFJ176	Fairchild Semi
6	R1, R2, R10, R24, R25, R27	1.00K	RES, FLM, THK, 0402, 1K, 1%	RC0402FR-071KL	Yageo
2	R14, R35	0	RES, FLM, THK, 0402, 0	RC0402FR-070RL	Yageo
1	R19	20K	RES, FLM, THK, 0402, 20K, 1%	RC0402FR-07100KL	Yageo
5	R20, R23, R29, RT1, RT2	10K	RES, FLM, THK, 0402, 10K, 1%	RC0402FR-0710KL	Yageo
3	R21, FB10, FB26	1.00K	RES, FLM, THK, 0402, 1.00K, 1%	RC0603FR-071KL	Yageo
5	R16, R17, R18, R22, R34	47K	RES, FLM, THK, 0402, 47K, 1%	RC0402FR-0747KL	Yageo
1	R26	5.6K	RES, FLM, THK, 0402, 5.6K, 1%	RC0402FR-075K6L	Yageo
2	R28, C12	2.21K	RES, FLM, THK, 0402, 2.21K, 1%	RC0402FR-072K21L	Yageo
2	R30, R31	20K	RES, FLM, THK, 0402, 20K, 1%	RC0402FR-0720KL	Yageo
1	R32	22K	RES, FLM, THK, 0402, 22K, 1%	RC0402FR-0722KL	Yageo
1	R33	100	RES, FLM, THK, 0402, 100, 1%	RC0402FR-07100RL	Yageo
1	U1	LM2937	IC, VREG, LDO, 5.0V, SOT-223	LM2937IMP-5.0/NOPB	TI
1	U2	C8051F530	IC, MCU, 8051, TSSOP20	C8051F530-C-IT	SiLabs
1	U6	MCP4251	IC, POT, DGTL, DUAL, TSSOP14	MCP4251-502E/ST	Microchip
1	U7	1G3157	IC, SW, ANLG, SPDT, SC70-6	SN74LVC1G3157DCKR	TI
1	U8	TSX561	IC, OPAMP, SMD, SNGL, SOT23-5	TSX561IYLT	ST



### Bill Of Materials, UXFFront Config Serial Adapter PCBA

<u>QTY</u>	<u>REFDES</u>	<u>Value</u>	<u>Description</u>	<u>MPN</u>	<u>MFR</u>
5	C101, C102, C103, C104, C105	0.1uF	CAP, CER, 0603, 0.1uF, 25V	CC0603JRX7R7BB104	Yageo
2	FB101, FB102	0	RES, FLM, THK, 0402, 0	RC0402FR-070RL	Yageo
1	P101	DRX I/O	CON, DSUB9, FEM, PCB-WW, VERT	L77-DE09S-F179	Amphenol
1	U101	MAX3232	IC, XCVR, DUAL, EIA-RS232, SO16	MAX232NSR	TI

### Bill Of Materials, UXFFront Radio Interface Cable

<u>QTY</u>	<u>REFDES</u>	<u>Value</u>	<u>Description</u>	<u>MPN</u>	<u>MFR</u>
1	P201	DSUB-9	CON, DSUB, 9 POS, MALE, Solder- cup	CC0603JRX7R7BB104	Yageo
1	P1	8pin, 1.5mm	CON, HSNL, 8 POS, FEMALE, CRIMP, 1.5mm	87439-0800	Molex
4	P1	Crimped wires	WIRE, PRE_CRIMPED, FEM, 300mm	79758-0016	Molex
2	P201	Screw	SCREW, 4-40, 0.25"LG, TRUSS HD	91770A092	McMaster
2	P201	Nut	NUT, 4-40	91841A005	McMaster
2	P201	Lock- washer	LOCKWASHER, #4, INT	91757A101	McMaster
8	P201	Heat- shrink	TUBING, HEATSHRINK, 1/16", 0.25" LG	FIT221B1/16 CL100	Alpha

