TSW Software V1.00 for the Arduino NANO Every, used with the uBITX transceiver from HF Signals (India)
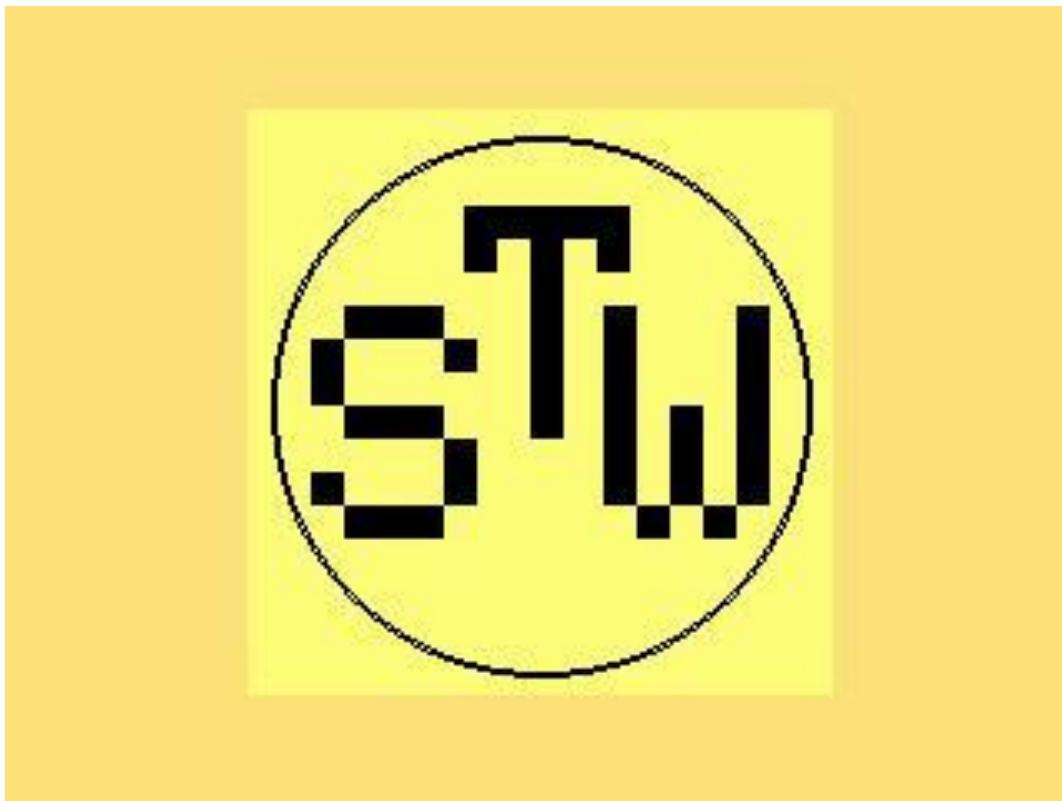
From the Triumvirate Skonk Worx www.w0eb.com and written by Ron, W2CTX

_____

TSW_NE_V6_V1.00 Splash Screen
Arduino NANO Every running on a V6 uBITX with TSW software

Introduction:

Since the Arduino people have released a much improved version of the NANO that was originally used in the uBITX V6 (and earlier but this software and manual are only for the uBITX V6), TSW's master programmer Ron, W2CTX, in a bout of boredom recently decided to try porting the TSW software originally written for the PJRC Teensy 4.0 over to the NANO Every and after a bit of testing by Jim, W0EB and rework by Ron, We at TSW believe we have a very nicely working version that will allow uBITX V6 owners to replace the factory supplied NANO with a newer and quite a bit better NANO "Every" that will DIRECTLY replace the existing, NANO, using the original Raduino that the factory supplies with the uBITX. The Every must have the pins soldered so that it will mount upside-down in the Raduino's MPU socked exactly in the same manner AND orientation of the originally supplied, older NANO MPU.

There is only ONE modification that needs to be made to the underside of the uBITX's main board and that is to solder a wire between the front panel Key jack's "Dash" Contact and the Microphone jack's "Ring" contact which provides a separate digital input for the keyer routine's dash input. This does not require removing any components or making any other modifications to the uBITX main board. (See detailed picture below).
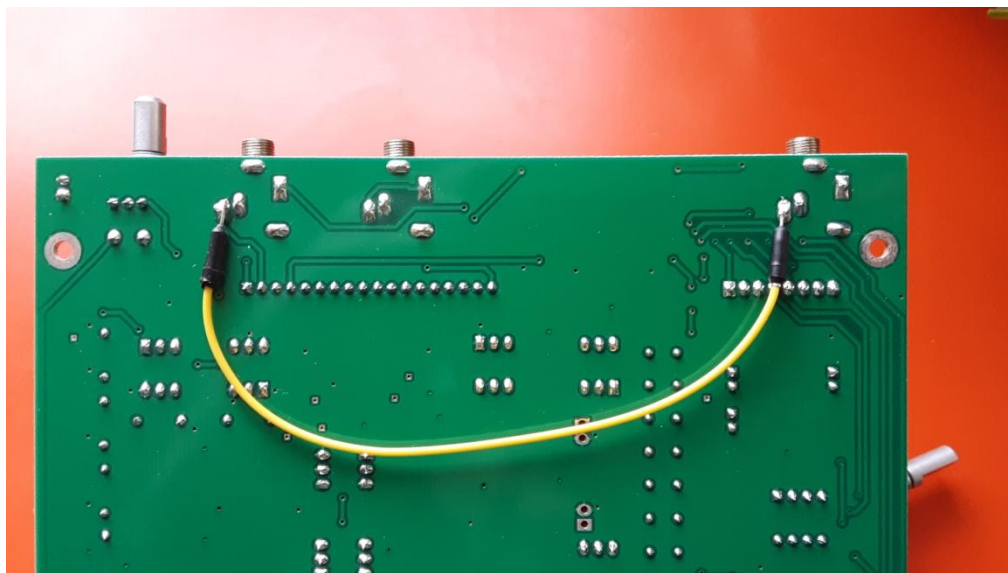
Carefully add this wire between the Key jack and PTT jack before loading the software and reassemble the main board into its case prior to adding the programmed NANO Every.

Acquiring your NANO Every:

You can order the Every from several sources. The most reliable is probably Amazon where the prices vary from around $18.00 US to more. It will take a few days to arrive, no matter where you order it from. Be sure it is a genuine Arduino NANO Every and not some other board as only the Every will work with this software.

Windows users, You will also need to download and install the latest release of the Arduino IDE. I suggest installing it in its own directory on your C:\ drive rather than in the "Program Files (X86) directory though so it doesn't get messed up by Windows updates.

(For Linux install info, contact W2CTX via his email contact address on www.w0eb.com)

Once you have the IDE installed, do the following:

Install EveryTimer using Sketch/Include Library/Manage Libraries.. type in EveryTimer

Install megaAVR board set Tools/Boards/Board Manager... type in megaAVR   (This will allow you to select Arduino EVERY as the board to program). Once you connect to your EVERY via its USB Micro-B connector you will need to select which serial port has been assigned to it. It should show up in the TOOLS menu when you click on "Port". A window will pop up and it will show which port the Every is on. If you don't see a port assigned to the Every, check to make sure you aren't using a "power only" USB cable. It must be Power AND Data.

We have an EEPROM initialization routine that sets the initial values so you don't have to worry about weird things happening with the program after your initial compile & load. This will be included (with instructions) in the Every program folder on the TSW website and should really be run first before loading the V1.00 software.

Now, Load the initialization software into the IDE and then, with the Every connected, board selected & port selected in the Tools menu, click on the UPLOAD button at the top left of the IDE window. It will compile quickly but takes around a minute or more to upload so be patient. The program will

run and initialize the EEPROM to get rid of random values to help prevent errors

Now, load the actual TSW Every software into the IDE and click on "Upload". Once you see "Upload Complete", you can disconnect the programming cable and plug the Every into your Raduino. ==Make sure the Every's USB connector is oriented EXACTLY like the original NANO was. Powering it up with the MPU installed backwards will destroy your Every so be careful!==

If you don't have one on hand, you should order a 1 foot long, panel mount, USB Micro-B female to male adapter cable to replace the old external program cable that originally comes mounted in the uBITX as the Every uses a Micro-B USB input instead of the older NANO's Mini-B. That will allow you to load new versions (If/when published) of the TSW software.

Now that you have your Every programmed and everything installed in the uBITX properly, power up the radio. Either press and hold the Encoder button or the face of the touch screen during power up. Once the splash screen has displayed it will enter the "Touch Screen Calibrate" routine. You need to initially calibrate the screen to be able to use it.
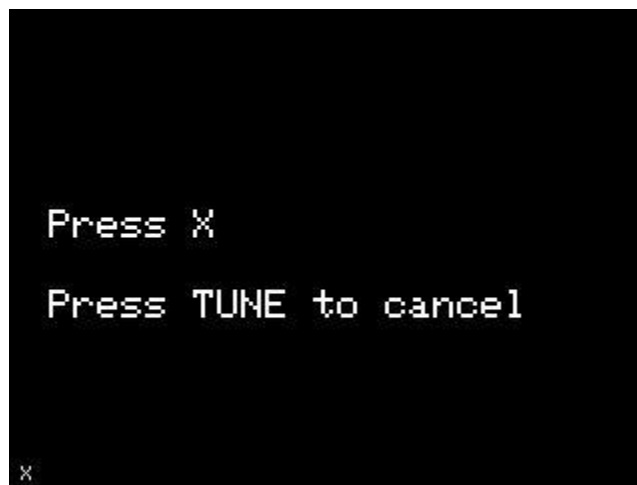
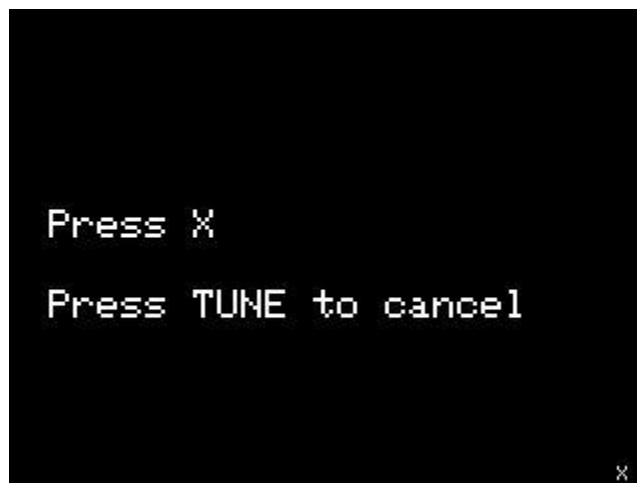The screen will look like the following:
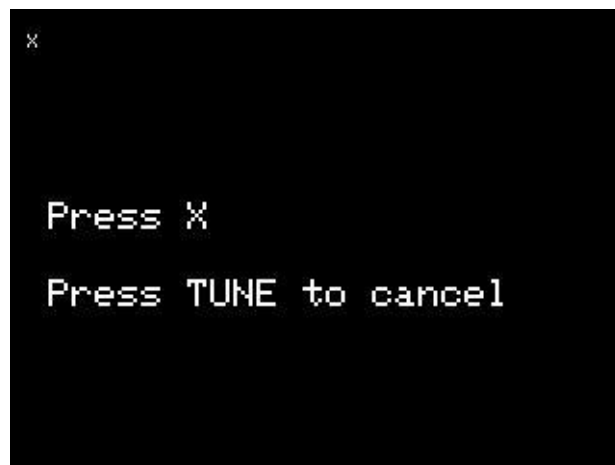
Preferably using a "Stylus" for accuracy, gently press the small x in the upper left corner. The x will next appear in the upper right corner.
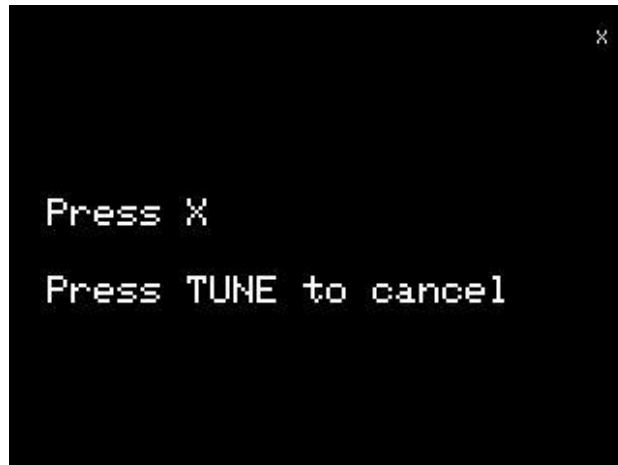
Press the small x in the upper right and it will move to the lower left corner.

Again press the small x and it will finally move to the lower right corner.

Once you press the final x, the touch screen will be calibrated and it will automatically save all the values to the Every's EEPROM. Finally, the following "Main Screen" will appear and your uBITX will be almost ready to operate with the new software.

This is only an example and was taken after the setup was complete. The screen you actually see will have different data in it, but will look essentially like this. This is the "MENU Page 1" screen.

Tuning Note:

The yellow cursor under the digit shown in the above screen indicates which digit will be tuned first as the tuning knob is rotated. This can be changed to any of the 5 digits to the left of its current position by simply touching that digit. All digits to the right of the cursor will remain stationary during any tuning operations. This is to facilitate rapid changes of frequency within a given band when desired. You also have two selectable VFO's, A and B. Selecting which one is active is simple, just touch the screen at the A or B position and that VFO will be selected and displayed in large numbers while the unselected one will be displayed in smaller numbers above the main frequency.

Operation:

The first things we need to do before using the radio are calibration of the BFO and Master Oscillator frequencies. The BFO needs to be done first to make sure the USB and LSB selections are right, so touch the Triangle at the lower center of the screen and it will switch to menu page 2 (shown below).

In order to be able to open the calibration routines, touch the word "Set" and it will open the following menu.

Make sure an antenna is connected to the radio and tune to a frequency with NO CW or SSB signals on it. Set the volume so you can hear the background noise well.

Touch "CAL BFO" and it brings up the BFO Calibration screen.

If the initialization program loaded & ran properly this is exactly what you should see. If the uBITX has not been calibrated previously and you see some other number, first touch factory reset. Next, using the main tuning knob, tune the BFO frequency to lower frequencies (it may tune backwards to the knob rotation) until the noise reaches its lowest pitch (center of the passband) Write this frequency down and save it. Next, keep tuning in the same direction until the pitch of the noise increases slightly. Write this frequency down and circle it. Next, tune the other direction until you pass the lowest noise frequency and keep going until the noise in the higher frequency sounds just like that on the lowest frequency (the circled one). Write this frequency down. Finally, tune to the lower frequency (the circled one) and, without disturbing the tuning, touch the "USER SAVE" button, and then touch USER EXIT. Your BFO is now initially calibrated and you will be returned to the Set Menu. Touch exit and return to the main screen.

Now, on the main screen, touch the band (in the example it's 20M) in the upper left of the display to bring up the band set menu shown below.

Touch the G/C button to change to General Coverage. This will allow you to select ANY frequency within the uBITX range without being band limited to the Amateur Bands.

Set the frequency to a known accurate frequency signal and tune it exactly zero beat in either USB or LSB (not CW). Set the mode to USB or LSB by touching the MODE area on the main screen – more on this later. This is critical that you be exactly zero beat with the signal you are using to calibrate with. We suggest WWV at 5.0 MHz if at all possible and not the 10 MHz signal as, unfortunately there are serious birdie signals at 10 MHz caused by the fundamentals of the oscillators in the NANO Every that are very very close to 10 MHz and interfere with the ability to hear a 10 MHz frequency well enough to get accurate calibration readings. Use the 7 MHz frequency for CHU Canada if you can.

Once you have the mode set to USB or LSB and the frequency set to the exact frequency published for a known station, again get into the Set menu and touch the CAL FRQ area. It will bring up the following screen:

Disregard the 7040 K (for KHz) frequency in the example, it should show the frequency you are tuned to from the Main Screen and you should be hearing the modulation (and the carrier unless the calibration is dead on already) of the calibration station. Tune until you hear the carrier of the signal and then tune it back until you are exact zero beat (keep turning up the volume until you can hear it well and get the last vestiges zeroed). When you are satisfied, be careful not to bump the tuning knob and touch USER SAVE to save the value in EEPROM. Then touch USER EXIT to return to main screen. Check to make sure the Zero Beat is dead on the display frequency and if not, do CAL FRQ again until it is. Sometimes, depending on band conditions, it may take two or more tries to get it right but once you have it set properly, the Master Oscillator crystal doesn't drift enough that you will need to re-calibrate any time soon. If it ever does need to be recalibrated, just follow these procedures and it should be good again for a long period of time.

Now that you have the oscillators calibrated, you can use the menus to customize the radio to your liking within the available parameters.

SET MENU:

A more thorough run through of the Set menu is probably necessary to start with. Explanation of items in this menu from the top down: Touch any item to select it and use the tuning knob to set the value where appropriate.

S Meter ON. Touch to turn on or off. On is only useful if an AGC is installed in the radio and a sample of the AGC voltage (MAX 5 V) is fed to pin A7 on the EVERY via the appropriate pin on the ENCODER connector to the Raduino. The value is shown as 24 and that is a reasonable value for most AGC units available for the uBITX. Adjust this up or down to set S9 = 50 microvolts of RF AT THE ANTENNA JACK.

Tone. This is the frequency of the CW Side tone in Hertz. Touch to select or deselect and use the tuning knob to set the freq (close but not perfectly exact). Once set, touch Tone again to save the value.

CW Dly. This is the length of time the radio stays in TRANSMIT (TX) mode when operating CW, after the last character element has been sent. Keeps the relays from clicking annoyingly and wearing out too fast. Value is time in milliseconds (1000 milliseconds = 1 second).

CAL FRQ and CAL BFO. These were explained fully in the calibration instructions.

Region. This is the IARU operating region and 1, 2 or 3 can be selected by touching Region. Each time it's touched, it will cycle to the next one. This

sets the Amateur band limits to those imposed for each IARU region in the world. Tuning is stopped at the band edges to keep the user from transmitting outside of the band edges imposed for the selected region.

To be able to tune outside of the region limits, set band to G/C (General Coverage) in the Band Manu.

Direct Frequency Entry:

On the main screen Menu 1, there is a "Freq" area at the bottom that, when touched, brings up a Direct Frequency Entry screen. The entries in this menu ARE limited to Amateur frequencies available within the IARU region that was selected in the Set menu. If you want to enter a frequency that is outside those limits, you must first, using the "Band" menu set the band to G/C (General Coverage) and then any frequency the uBITX can tune may be entered.

Operation is pretty self explanatory. Touch each digit of the frequency in order, use the <- to delete mistakes, the Can to exit without saving and once you have the frequency you want, touch OK to enter it into the selected VFO (A or B) on the main screen and it will exit with that frequency displayed. It doesn't get much simpler than that.

Memory Channels:

The software has enough EEPROM to support 10 memory channels which can contain mode (C,U and L) for CW, USB and LSB, and the main VFO's frequency.

To load a channel, first set the mode, & sideband, then enter the frequency on the Menu 1 main screen. Then touch Chan to get the screen shown above. Touch the channel slot you want to use for that frequency and then touch VFO>M to fill that slot. This works for any band including G/C.

To load a saved channel into the "in use" VFO, touch a non-empty channel to select it and then touch M>VFO. Once you have done that, touch EXIT and you will be taken to the Menu 1 screen with the frequency and mode information filled in.

If you no longer need a channel and don't have an immediate replacement for the information in that channel, touch the channel slot to select it and then touch Blank. This will delete the information and leave you with a blank slot at that position, ready to fill with new info at some later time. You can also replace existing channel data with information from the main screen by simply touching the VFO>M button on this screen.

MODE:

We've touched on the MODE menu during the calibrate routines, but let's go into a bit more detail just to make sure.

To enter the mode menu, you touch the MODE (in this case USB) area on the screen as shown above. (The Modes can be USB, LSB, CW, CWR and CWP).

Modes as set are the same for both receive and transmit.

Touch on the desired mode in the menu and it will be selected.

Modes are:
USB = SSB Upper Sideband
LSB = SSB Lower Sideband

CW

CWR = CW Reverse (Opposite sideband selected – normally it is LSB)

CWP – CW Practice. Transmitter is inhibited and keyer can be used for practice. The receiver is still active so practice can be done with incoming QRM to aid in learning.

CW setup and operation:

Using the mode menu, select CW, CWR or CWP. Next, decide which type of key you are using. Key Paddles (either Iambic or single lever) the default is Npaddle (as shown on the main menu screen (Page 1 or Page 2). If you are using a different key, your options are:

Npaddle – Single Lever or Iambic paddle(s) with the connections of Dot=Tip contact, Dash=Ring contact and ground=sleeve contact.

Rpaddle -- Single Lever or Iambic Paddle(s) with the Dot/Dash connections reversed. Dot=Ring contact, Dash=Tip contact, and ground=sleeve contact.

Manual – Hand Key with the connection of Main contact=Tip contact and ground=sleeve contact. Sleeve contact=no connection.

Cootie – "Cootie Key" with both contacts to the Tip connection and sleeve to the ground. Differs from the other types because you can also use a single or dual lever paddle as a "Cootie" due to the fact either the Tip or Ring contact will produce a character element for as long as either are pressed in this configuration.

The paddle/key options are selected by touching the main screen's Paddle area (Default Npaddle) each time you wish to change the key type. It will cycle through the options one at a time so if you don't like a selection, just keep touching until you are at the one you want.

The keyer does not rely on voltage divider selection for the dot and dash as the original NANO software did. The first thing you did before loading this software was to make a fairly simple modification to the underside of the uBITX main board, connecting a wire between the ring contact on the CW Key jack to the ring contact on the MIC connector.

This allows the Microphone's Push To Talk (PTT) line to be used as a separate digital input on the NANO Every and allow for individual Digital inputs for the Dot and Dash signals to the keyer routine. Doing this is possible as PTT is used only in SSB's USB and LSB modes, with separate Transmitter (TX) keying during CW operation. That makes dot & dash timing in the keyer much more accurate and allows for more precise keying using the paddle key options.

When using the keyer in Npaddle or Rpaddle mode, a comfortable CW sending speed must be selected. As shown in the following screen, to set the keyer speed, touch the speed shown on the screen. It will change color from green to white and you may set the keyer speed from 5 wpm to 75 wpm. Once the desired speed is set, touch the number again. That will save the value and return the display to its green color.

SSB Operation:

For SSB, simply select the SSB mode (USB/LSB) appropriate for the band you are on using the Mode menu on the main page (1 or 2), plug in your microphone (Electret microphone with the Positive (Plus +) contact to the plug's TIP connection, PTT contact to the plug's Ring connection and the shield (ground) to the plug's Sleeve connection.   Make sure the connections are correct as reverse polarity could damage the microphone element. The microphone gain is set internally to the radio and should not need to be changed for normal operation. It is best NOT, repeat NOT to use an amplified microphone with the uBITX V6.

Digital Mode Operation:

To operate any of the digital modes allowed on the bands in your region, an external computer with the appropriate digital mode program & sound card must be used. Set the mode to either USB or LSB and connect the digital transmit audio from the computer's sound card to the microphone jack's "Tip" connection with the PTT to the "Ring" and shield of the cable to the "Sleeve". Set your computer's sound card output level to the lowest possible that will produce good transmit audio (if possible listen to it with a separate receiver) and reliable contacts. Do NOT set it any higher than needed or it may damage the uBITX V6's microphone input amplifier and if that happens, SSB and Digital mode operation will not be possible until the fault is repaired.

Other useful menus:

Main Display Page 1 (Menu 1)   Main Display Page 2 (Menu 2)

Along the bottom of each of these 2 pages is a selection strip for useful items. We've already explained some of them (Freq, Chan and Set and Ver) in previous paragraphs.

It's time to explain how to use the Receiver Incremental Tuning (RIT), Split, A->B and Lock items.

Let's say you are working a station whose signal keeps drifting away from your initial frequency, and you need to re-tune to keep that signal in your receiver's passband but you don't want to move your transmit frequency as the other station may be using a separate receiver & transmitter and it's just his/her transmitter that's drifting so touch RIT and it will lock your transmitter frequency to that indicated on your display but allow the receiver to be tuned independently. This item has a very wide range so be careful tuning.

RIT will show in green instead of white when it is activated and your TX frequency will be displayed in white just below the Mode and CW speed items. The above example is for CW, but RIT works in any mode. To turn it off, simply touch RIT again. It will turn back to white and your RX will return to the original frequency (shown by the TX display). The TX display will disappear. And the main frequency display will show the original RX/TX frequency as it was prior to RIT being selected.

Next is Split which is somewhat similar to RIT but used in cases where you want to use separate TX & RX frequencies to make it easier to separate calling stations if you are operating from a popular location or during DXpedition. This even allows "Crossband" operation where your TX frequency is on one band (7125.60 KHz in the example) and your RX frequency is on another band (in this example, 14105.40 KHz). The modes must be the same, however.

First set the frequency you will be transmitting on and then touch Split.

Now, go to the frequency (and band if different from TX) you wish to receive on and you are ready to operate. To turn off Split, simply touch it again and it will go back to RX and TX on the frequency show on the main page. (in this case 14105.40).

The next item is A-B>. This software has two VFO's that can be locked together or operated independently as we have seen in the above examples, and they can be on widely different frequencies. Suppose you are done with that sort of operation and want to have both VFO's on the same band & frequency. When you touch A->B, whatever frequency is displayed for VFO A, is also entered automatically into VFO B and the values are saved. This happens each time you touch A->B.

Example: Before A->B is pressed.

Example: After A->B has been pressed.

The final item that affects the uBITX transceiver operation is Lock.
Say you are NET control for a traffic or other net and you want to make sure you don't change any settings accidentally, once you have everything

set up the way you want it, simply touch Lock and you will see the following screen:

The Lock item will turn green indicating it is active and the main frequency display will turn red in color and a white L will appear immediately below the selected VFO (in this case A), indicating that it's locked and cannot be changed. Touching Lock again will turn the feature off and everything reverts to normal operation. Neither RIT or Split can be used while Lock is active.

Ver: Anytime you want to see which version of the software you are using simply touch Ver and the Version information screen will load. Touch anywhere on the screen to close it and return to the main screen.

Manual Credits:

 website: http://www.w0eb.com

Software Author: Ron Pfeiffer, W2CTX (w2ctx@yahoo.com)

Please Email Ron to report program bugs, or problems compiling/loading the program.

Manual Author: Jim Sheldon, W0EB (w0eb@cox.net)

Manual: Copyright © 2022 by Jim Sheldon, W0EB, all rights reserved.

Note: The uBITX software referred to and explained in this manual is released into the public domain and is made freely available through the Triumvirate Skonk Worx (TSW) website listed at the top of this page.

This manual may be freely distributed as long as the contents remain unchanged by anyone other than the author and full credit is given to the author and any other persons mentioned in this manual.

Manual Version 1.0, 11 November 2022, 17:00 UTC