

The background of the slide is a dark blue space filled with numerous light trails. These trails are primarily in shades of blue and green, with some appearing as bright, thin lines and others as thicker, more diffuse streaks. The trails are curved and appear to be moving across the frame, creating a sense of motion and depth. The overall effect is reminiscent of a star trail or a nebula.

GETTING STARTED USING RASPBERRY PI IN THE SHACK (PART 2)

Jack Weaver – AA5VZ

I love this hobby! Where else can you sit in a hotel room in Pittsburgh PA and enjoy a digital QSO on a laptop with a fellow Ham in France, using your transmitter & antenna in Texas via a Raspberry Pi computer connected to the internet? A strange thing to consider one's own signals passing overhead on their way to Europe and back!

December, 2017

INTRODUCTION

The Raspberry Pi Alternative for WSJT-X

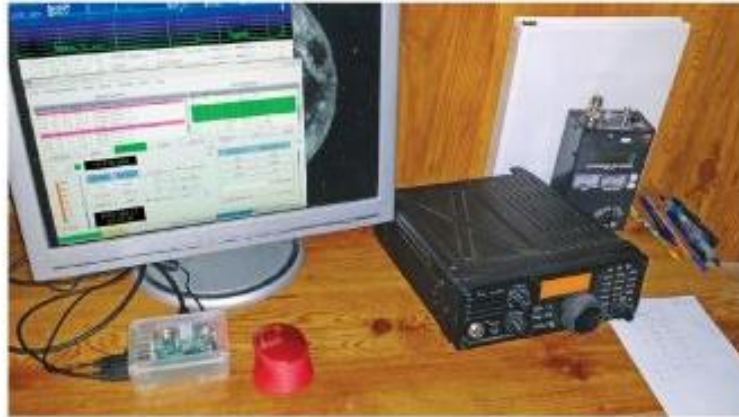
Turn an inexpensive microcomputer into a digital communication machine.

Thomas Kocourek, N4FWD

In the "Eclectic Technology" column in the April 2017 issue of QST, Chuck Kelly, W9MDO/VE1MDO, described a portable option for running WSJT-X digital mode software with a Raspberry Pi 3 microcomputer and a miniature LCD touchscreen. In this article, Thomas Kocourek, N4FWD, presents a similar solution, but with the emphasis on using the Pi as a dedicated home station computer for JT65, JT9, and WSPR — Ed.

As we slide into the oncoming solar minimum, it's no surprise that we're seeing an uptick in popularity for digital modes, such as JT65 and JT9, as well as the WSPR digital beacon mode. JT65 and JT9 can support contacts on the HF bands under conditions that would render other modes unusable. And for those interested in HF propagation studies, WSPR is ideal.

All three modes are available in the free WSJT-X software package, created by Dr. Joe Taylor, K1JT. In addition to



The author's station, with his Raspberry Pi 3 microcomputer at lower left, in its transparent case.

around your ham shack. However, here is a list for those starting from scratch:

- **A Raspberry Pi 3 microcomputer.** For beginners, I strongly recommend a "kit," such as those offered by CanaKit (see Amazon and other sources), because these packages include almost everything you'll need, often including a case and power supply. Prices range

your monitor. Considering the small size of the Raspberry Pi, I'd recommend a lightweight cable to keep everything mechanically stable.

- **A USB "A-B" style cable.** This cable will link your Raspberry Pi to your interface or transceiver.

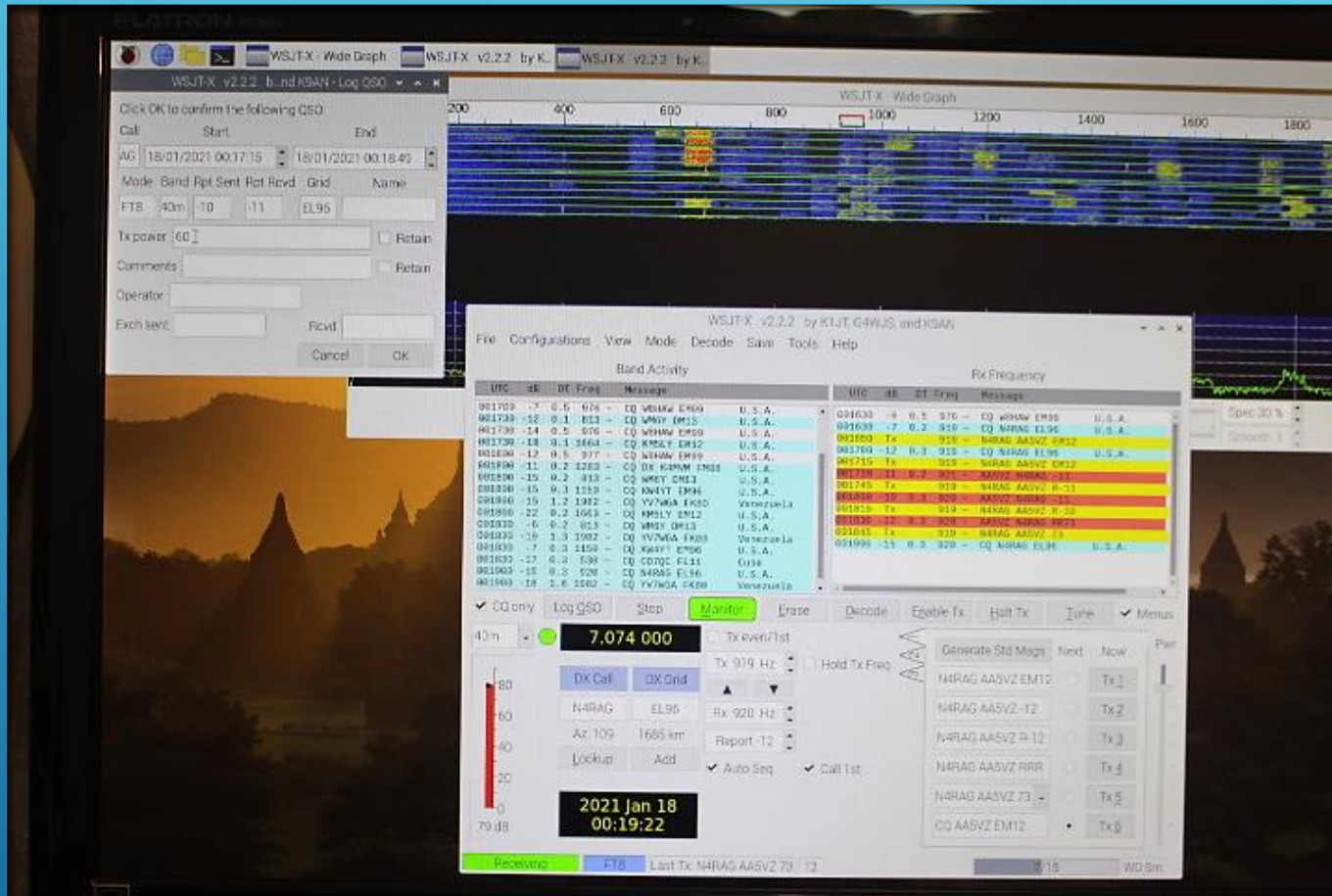
- **A keyboard and mouse.** To keep cabling to a minimum, I recommend a

WHERE IT ALL STARTED

QST Article, July 2017
Thomas Kocourek,
N4FWD

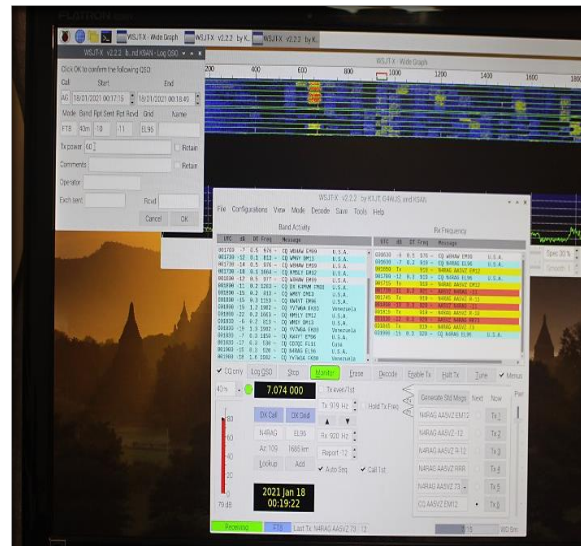
CURRENT ACTIVITY

- ▶ FT-8 Digital Mode
- ▶ Raspberry Pi-4
- ▶ Kenwood TS-590
- ▶ USB Direct Audio Interface
- ▶ Wireless Keyboard/Mouse
- ▶ >250 QSOs from Dec thru March



GETTING STARTED... MOVING FORWARD

- ▶ Assemble a Raspberry Pi-4 Workstation
- ▶ Load the base Operating System (O/S)
- ▶ Install and Configure Ham Radio Apps
- ▶ Interface the Pi with your Station
- ▶ Get on the Air!

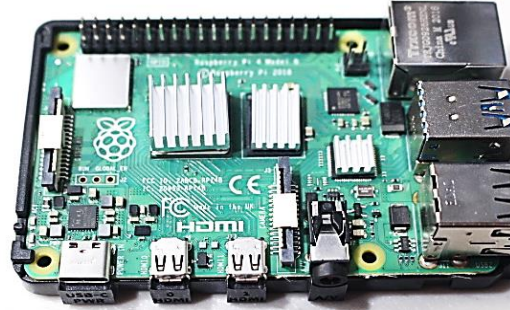


RECOMMENDED READING

- ▶ **WSJT-X User Guide – Available On-Line**
- ▶ **https://physics.princeton.edu/pulsar/k1jt/wsjt-x-doc/wsjt-x-main-2.3.1_en.html#NEW_FEATURES**

- ▶ **FL-Digi User Guide – Available On-Line**
- ▶ **<http://www.w1hkj.com/FlidigiHelp-3.21/html/index.html>**

...OFF WE GO!



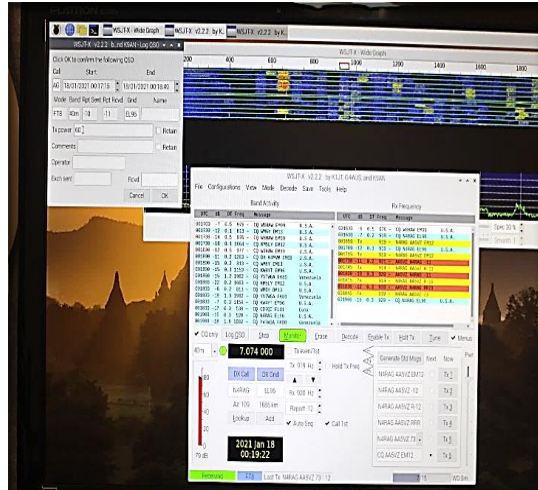
PART 1 (REVIEW)

- ▶ Procured a Pi-4 kit
- ▶ Assembled the components
- ▶ Assembled a Pi-4 work-station
- ▶ Installed NOOBS
- ▶ Installed/Updated the O/S
- ▶ Backed up our System SD Card(s)
- ▶ Allowed time for familiarization



PART 1 (REVIEW)

- ▶ Recommended add'l tools and free software to format and back up SD cards and System Files (see below)
- ▶ <https://www.sdcard.org/>
- ▶ Download / Install "SD Memory Card Formatter for Windows"
- ▶ <https://sourceforge.net/projects/etcher-mirror/>
- ▶ Download / Install "Etcher"



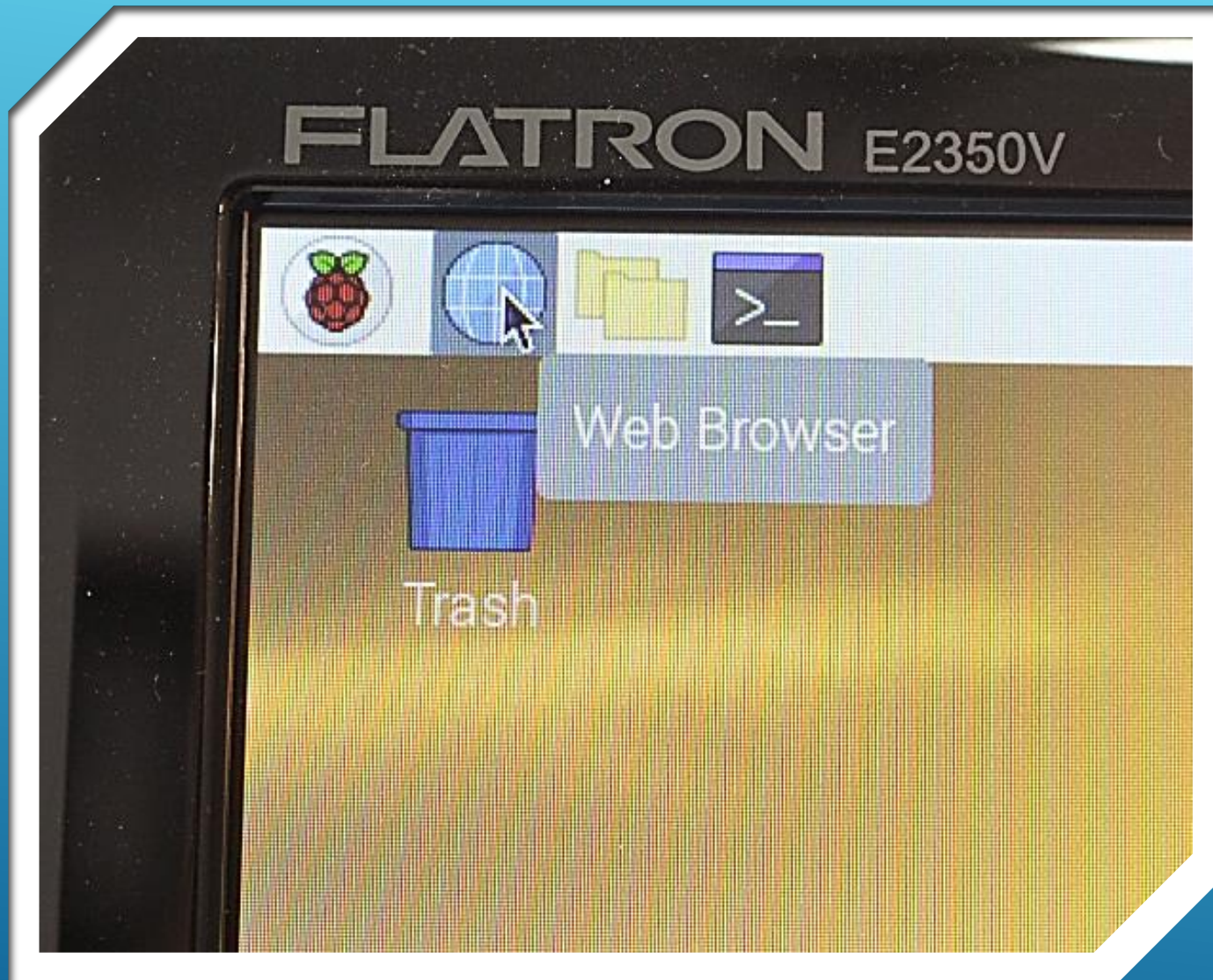
PART 2 (TODAY)

- ▶ Install WSJT-X (FT-8, JT-65, and others)
- ▶ Supplemental Addition - Install FL-Digi (PSK-31, etc) - TBD
- ▶ Interface the Pi-4 to your Radio
 - ▶ Audio Sound Card
 - ▶ Direct (USB)
- ▶ Configure the Interface
- ▶ Configure WSJT-X App
- ▶ Configure your Radio
- ▶ Get on the Air
- ▶ Have Fun!



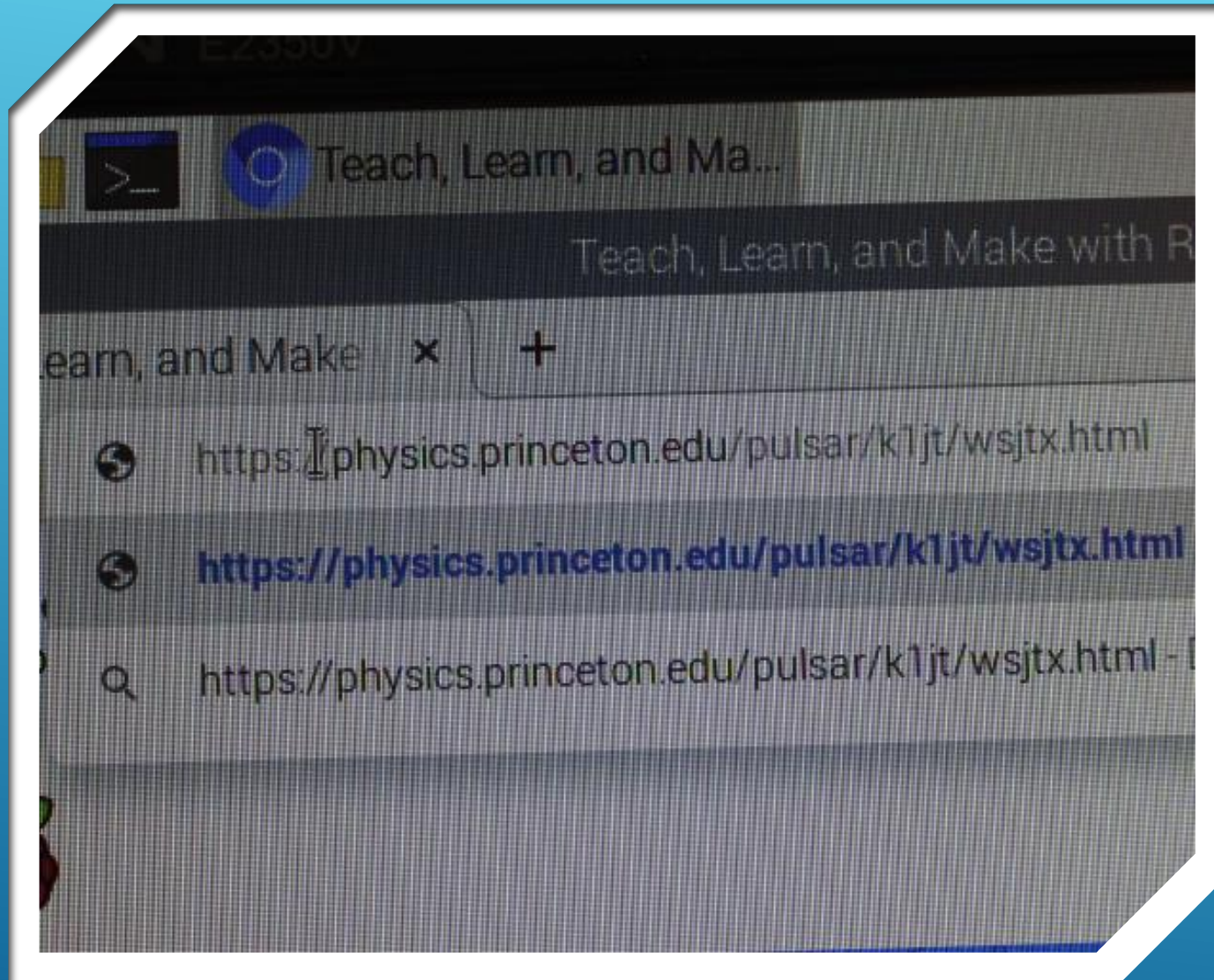
INSTALL WSJT-X

- ▶ **Install WSJT-X (for FT-8, JT-65, and others)**



INSTALL WSJT-X

- ▶ Open the Web Browser



INSTALL WSJT-X

- ▶ Type in the following:
- ▶ <https://physics.princeton.edu/pulsar/k1jt/wsjt.html>

WSJT Home Page

physics.princeton.edu/pulsar/k1jt/wsjt.html

WSJT-X

[Home](#)
[WSJT-X](#)
[WSJT](#)
[MAP65](#)
[WSPR](#)
[SimJT](#)
[Program Development](#)
[References](#)
[Support](#)

Description

WSJT-X implements communication protocols or "modes" called **FST4**, **FST4W**, **FT4**, **FT8**, **JT4**, **JT9**, **JT65**, **Q65**, **MSK144**, and **WSPR**, as well as one called **Echo** for detecting and the Moon. These modes were all designed for making reliable, confirmed QSOs under extreme weak-signal conditions.

JT4, **JT9**, and **JT65** use nearly identical message structure and source encoding (the efficient compression of standard messages used for minimal QSOs). They use timed 60-secc and **JT65** were designed for EME ("moonbounce") on the VHF/UHF/microwave bands. **JT9** is optimized for the MF, and HF bands. It is about 2 dB more sensitive than **JT65** while (available in WSJT-X 2.4.0 and later) offers submodes with a wide range of T/R sequence lengths and tone spacings.

FT4 and **FT8** are operationally similar but use T/R cycles only 7.5 and 15 s long, respectively. **MSK144** is designed for Meteor Scatter on the VHF bands. These modes offer enhanced nonstandard call signs and some popular contests.

FST4 and **FST4W** are designed particularly for the LF and MF bands. On these bands their fundamental sensitivities are better than other WSJT-X modes with the same sequence lengths and rates of information throughput. **FST4** is optimized for two-way QSOs, while **FST4W** is for quasi-beacon transmissions of **WSPR**-style messages. **FST4** and **FST4W** do not require the phase locking of modes like EbNaut.

As described more fully on [its own page](#), **WSPR** mode implements a protocol designed for probing potential propagation paths with low-power transmissions. **WSPR** is fully implemented "band-hopping".

Latest General Availability (GA) release: WSJT-X 2.3.1

WSJT-X 2.3 provides a number of features and capabilities that are new since version 2.2. A list can be found in the WSJT-X 2.3 User Guide [here](#). The first several sections of the program changes since the GA release of WSJT-X 2.2.

Upgrading from a previous version will be straightforward. There is no need to uninstall or move any files. If you want to make sure to have the latest list of default working frequencies, click in the Working Frequencies list, and select **Reset**.

Documentation: The [WSJT-X 2.3 User Guide](#) is available online. This document should always be your first source for help. Use your browser's search facility to find a keyword.

- [English \(v2.3\)](#) - html
- [English \(v2.3\)](#) - pdf
- [German \(v2.3\)](#) (OE1EQW)
- [Swedish \(v1.9\)](#) (SM7VRZ)
- [French \(v2.0\)](#) (ON4CN)
- [Norwegian \(v2.2\)](#) (LA6VQ)
- [Italian \(v2.0\)](#) (I28EEI)
- [Russian \(v2.1\)](#) (RA3TOX)

INSTALL WSJT-X

- ▶ This takes you to the **WSJT-X Web-Page**

WSJT Home Page

physics.princeton.edu/pulsar/k1jt/wsjt.html

Versions of *WSJT-X* labeled with a "-rcx" suffix, for example *WSJT-X* v2.2.0-rc4, are **Release Candidates** sometimes offered temporarily for beta testing purposes. You should upgrade. The -rc# program versions are not suitable for long-term general use.

Installation packages for *WSJT-X* 2.3.1

Windows:

- Version 2.3.1 for Windows: [wsjtx-2.3.1-win32.exe](#). (Win 7, Win 8, and Win 10).
- Version 2.3.1 for Windows: [wsjtx-2.3.1-win64.exe](#). (Win 7, Win 8, and Win 10).

Linux:

Installation instructions for Linux can be found [here](#) in the User Guide. Download the package file appropriate for your system, from the list below. (Versions installable with "apt-get" package maintainers create the packages.)

- Version 2.3.1
 - Debian, Ubuntu 18.04 LTS, ... (32-bit): [wsjtx_2.3.1_i386.deb](#)
 - Debian, Ubuntu 20.04 LTS, ... (64-bit): [wsjtx_2.3.1_amd64.deb](#)
 - Fedora 30, RedHat, ... (32-bit): [wsjtx-2.3.1.i386.rpm](#)
 - Fedora 33, RedHat, ... (64-bit): [wsjtx-2.3.1.x86_64.rpm](#)
 - Raspberry Pi OS Buster, ARMv6, ... : [wsjtx_2.3.1_armhf.deb](#)
 - Raspberry Pi OS Buster, arm64 (64-bit): [wsjtx_2.3.1_arm64.deb](#)

Note: these packages are unlikely to install properly on Linux distributions with required dependencies at lower versions than those on the named distributions. In such cases buildir 2.0.

Mac OS:

Installation instructions for Mac OS can be found [here](#) in the User Guide.

- Version 2.3.1 for macOS 10.13 and newer: [wsjtx-2.3.1-Darwin.dmg](#)

Source Code:

WSJT-X is licensed under the terms of Version 3 of the GNU General Public License (GPL). Development of this software is a cooperative project to which many amateur radio operators please have the courtesy to let us know about it. If you find bugs or make improvements to the code, please report them to us in a timely fashion.

Build and installation instructions are in the INSTALL file inside the tarball.

- Source code for *WSJT-X* 2.3.1: [wsjtx-2.3.1.tgz](#)

Candidate release: *WSJT-X* 2.4.0-rc4

Candidate releases are intended for beta testers: individuals interested in testing the program's new features and providing feedback to the WSJT Development Team. This is the first introduces a new digital mode called Q65 designed for minimal two-way QSOs over especially difficult propagation paths including EME and most types of scatter. Be sure to read [this](#)! Send bug reports and feedback to wsjt-devel@lists.sourceforge.net. You will need to subscribe to the list in order to post there.

Installation packages for *WSJT-X* 2.4.0-rc4

Windows:

Installation instructions for Windows can be found [here](#) in the User Guide.

- Version 2.4.0-rc4: [wsjtx-2.4.0-rc4-win32.exe](#). (32-bit Windows 7 or later).
- Version 2.4.0-rc4: [wsjtx-2.4.0-rc4-win64.exe](#). (64-bit Windows 7 or later).

Linux:

INSTALL WSJT-X

- ▶ Scroll down the page and stop at the Linux package list for versions 2.3.1

can be found [here](#) in the User Guide. Download the package file and install it (see the instructions for each package.)

Ubuntu LTS, ... (32-bit): [wsjtx_2.3.1_i386.deb](#)
Ubuntu LTS, ... (64-bit): [wsjtx_2.3.1_amd64.deb](#)
Fedora (32-bit): [wsjtx-2.3.1.i686.rpm](#)
Fedora (64-bit): [wsjtx-2.3.1.x86_64.rpm](#)
Raspbian (ARMv6): [wsjtx_2.3.1_armhf.deb](#)
Raspbian (arm64 (64-bit)): [wsjtx_2.3.1_arm64.deb](#)

to install properly on Linux distributions with required dependencies.

wsjtx 2.3.1 can be found [here](#) in the User Guide.

0.13 and newer: [wsjtx-2.3.1-Darwin.dmg](#)

INSTALL WSJT-X

- ▶ From the 2.3.1 version list select:
- ▶ “wsjtx_2.3.1_armhf.deb”

WSJT-X is licensed under the terms of Version 3 of the GNU General Public License. If you find bugs or have suggestions, please have the courtesy to let us know about it. If you find bugs or make suggestions, please have the courtesy to let us know about it.

Build and installation instructions are in the INSTALL file inside the tarball.

- Source code for WSJT-X 2.3.1: [wsjtx-2.3.1.tgz](#)

Candidate release: WSJT-X 2.4.0-rc4

Candidate releases are intended for beta testers: individuals interested in trying out new features. They are not intended for minimal users.

This type of file can harm your computer. Do you want to keep wsjtx_2.3.1_a...deb anyway?

Keep

Discard

INSTALL WSJT-X


- ▶ Observe message at bottom left corner of screen
- ▶ Select "KEEP"

Build and installation instructions :

- Source code for *WSJT-X 2.3.1*

Candidate release: *WSJT-X 2.3.1*

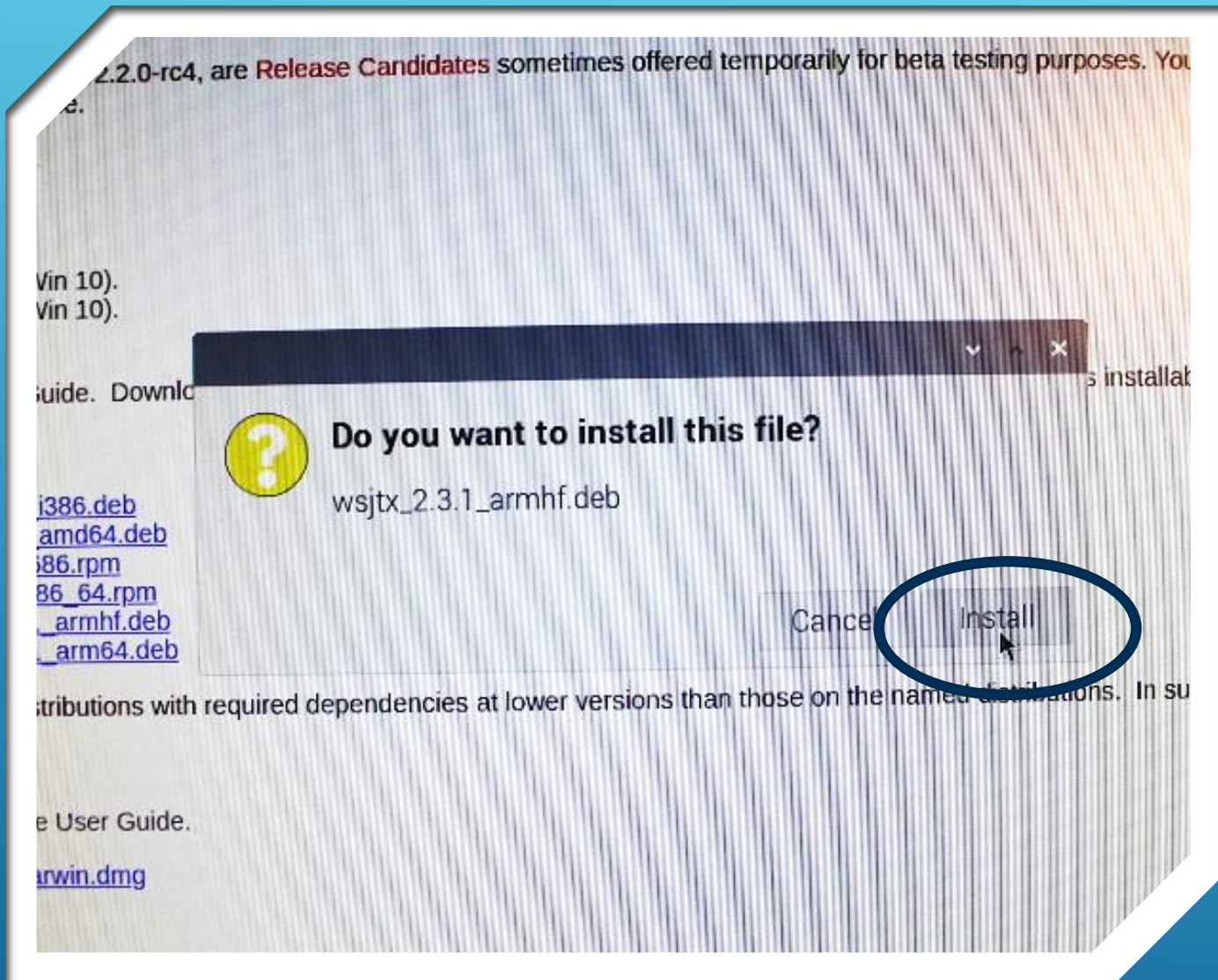
Candidate releases are intended for

 wsitx_2.3.1_a...deb ^



INSTALL WSJT-X

- ▶ To continue the installation, click on this item at bottom left corner of screen

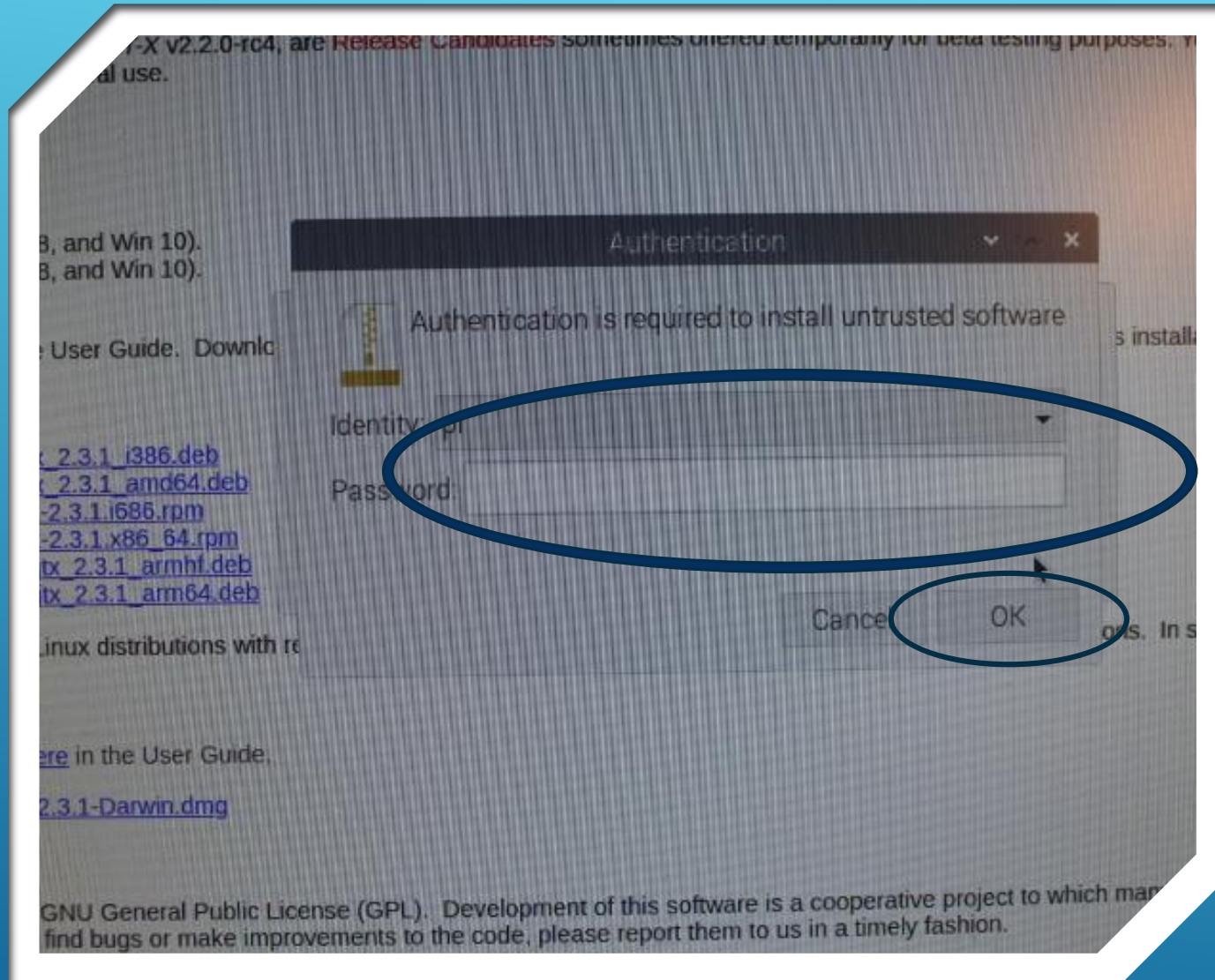


INSTALL WSJT-X

- ▶ The following message box will appear.
- ▶ Click the “Install” button.
- ▶ This will initiate the download of the selected file from the WSJT-X web-site to the “Downloads” directory of the Raspberry Pi.

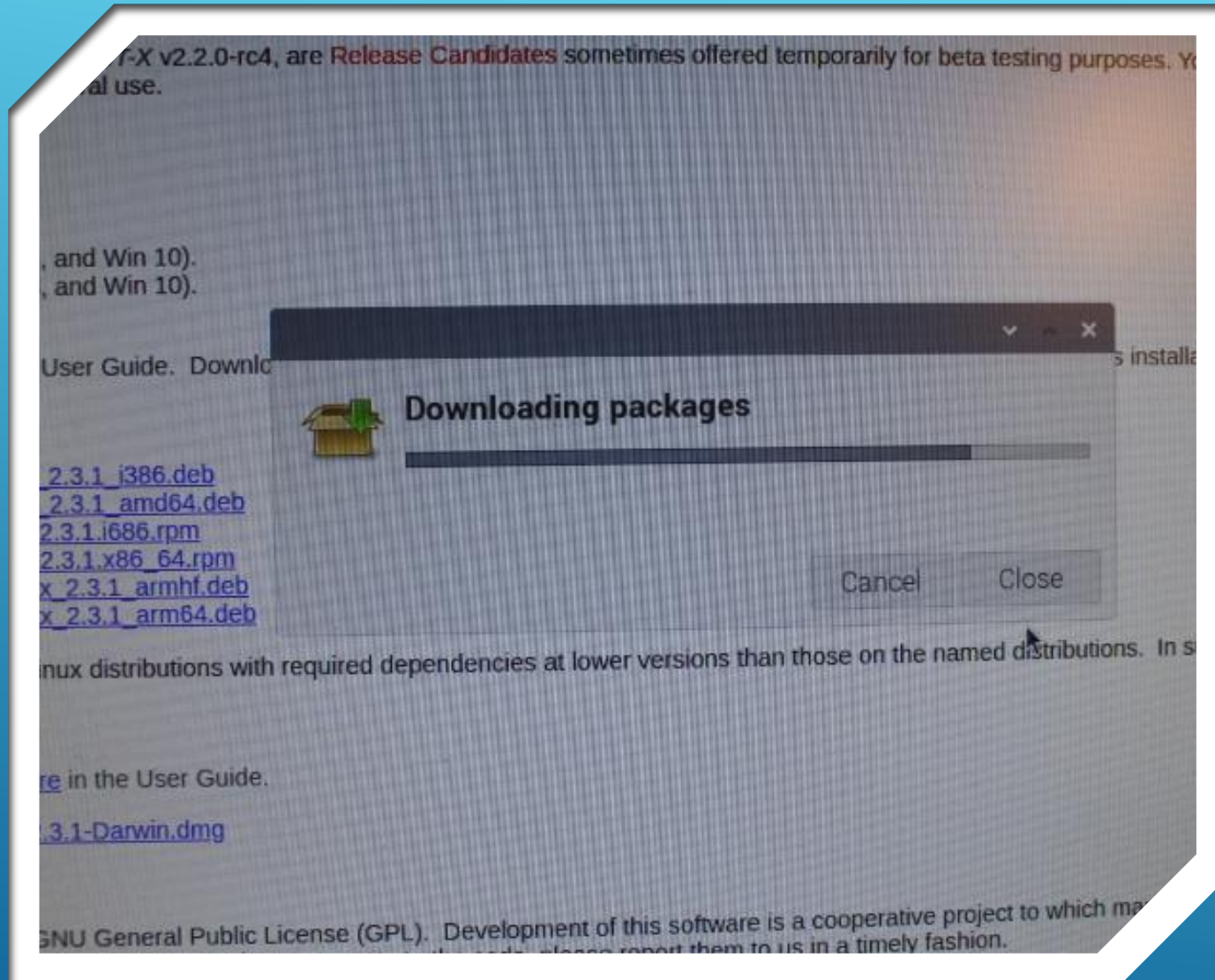
INSTALL WSJT-X

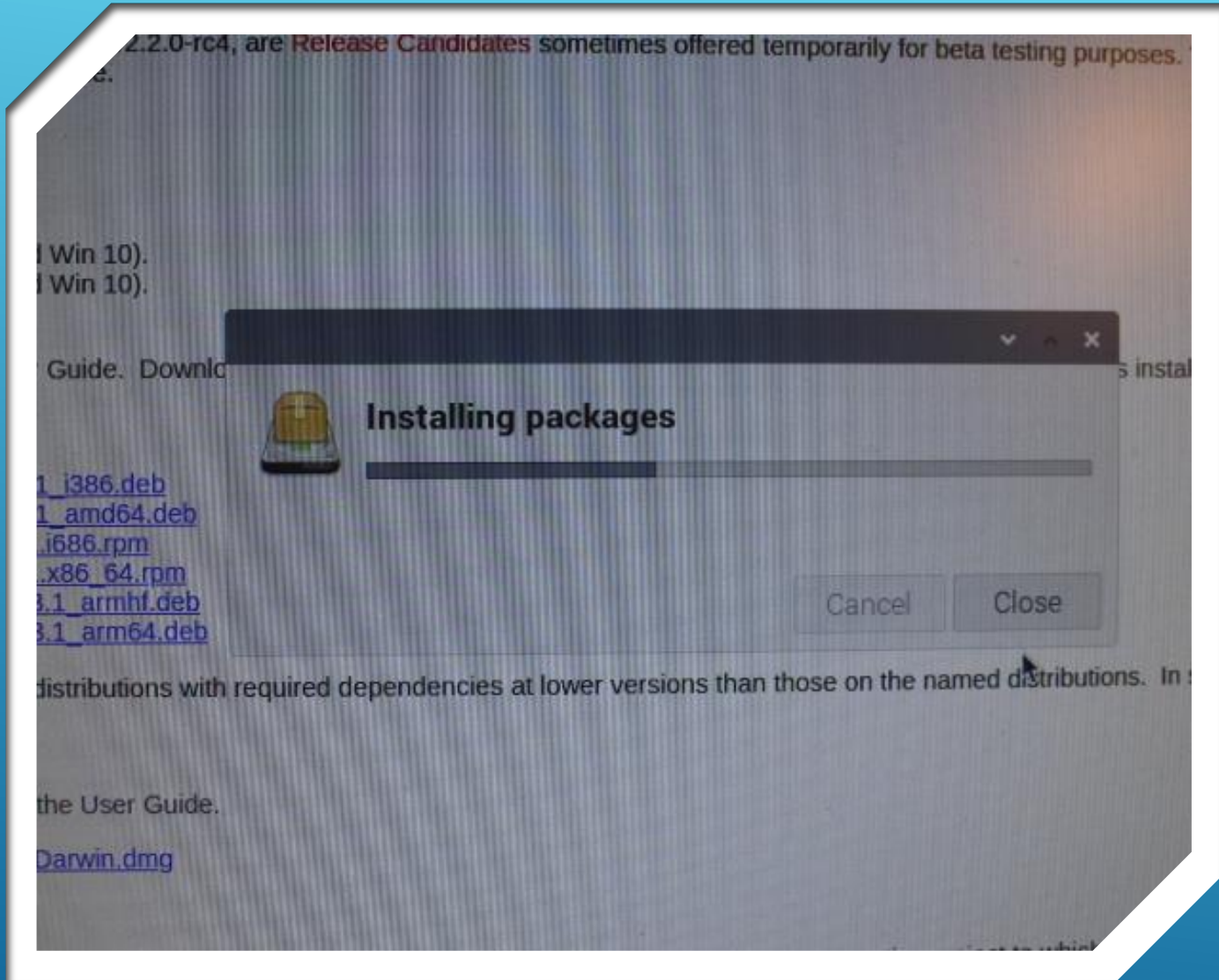
- ▶ If you see this message box, it is asking you for your pi password.
- ▶ Type-in: raspberry
- ▶ Then click “OK”
- ▶ This should allow the file download to continue



INSTALL WSJT-X

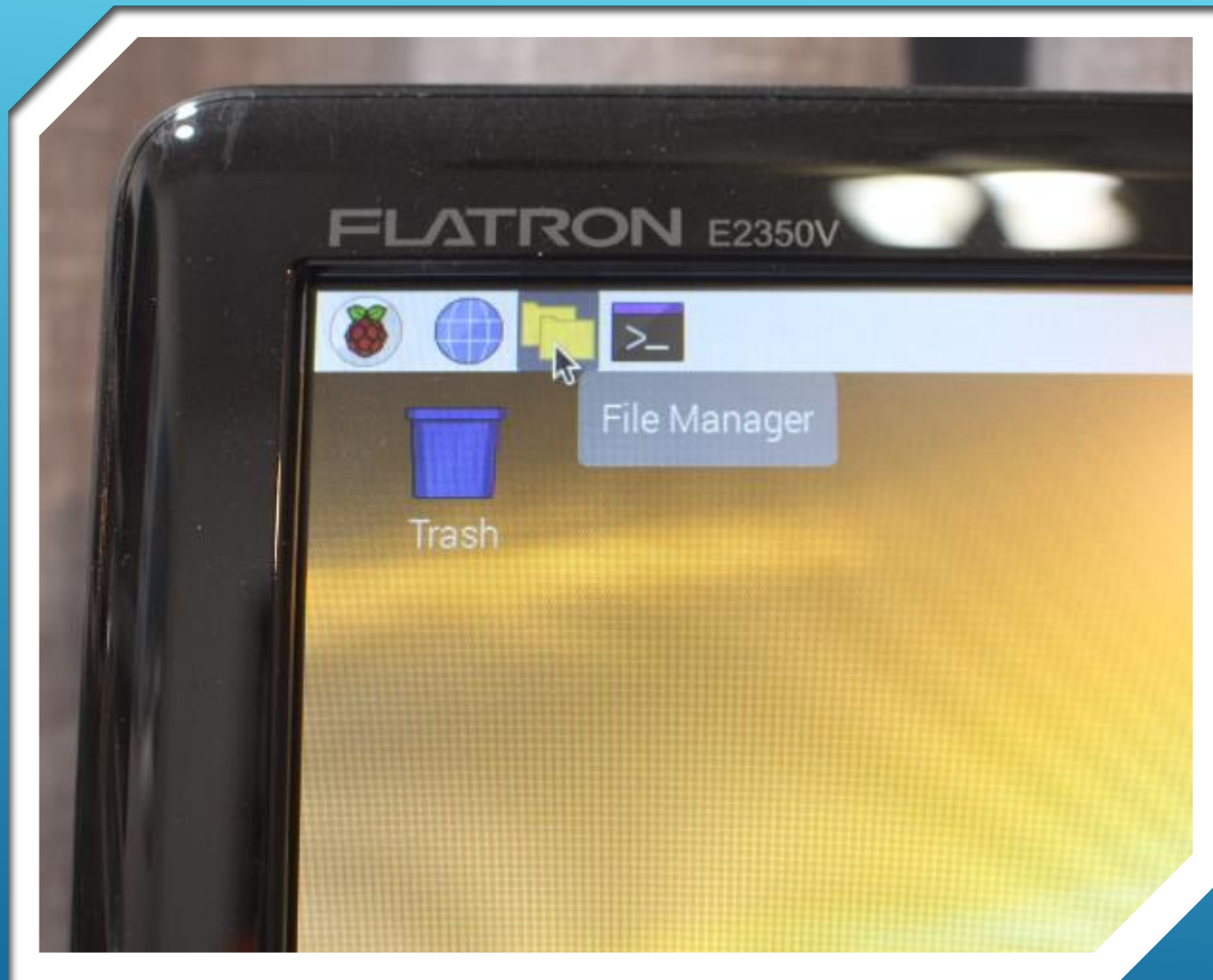
- ▶ Success – the files are downloading...





INSTALL WSJT-X

- ▶ And being assembled into a package folder in the Downloads directory

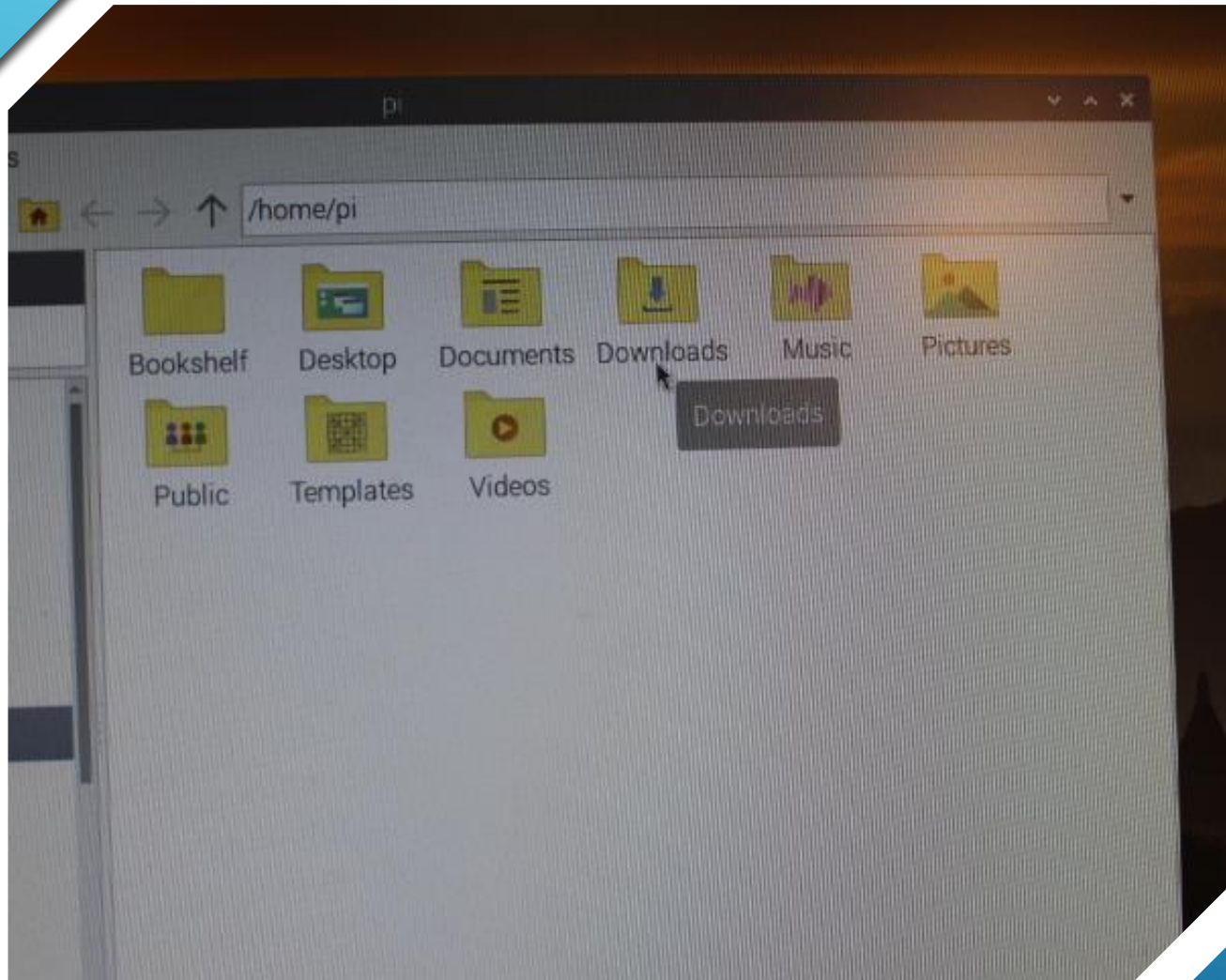


INSTALL WSJT-X

- ▶ To verify the files downloaded successfully select **File Manager** on the **Menu Bar**.

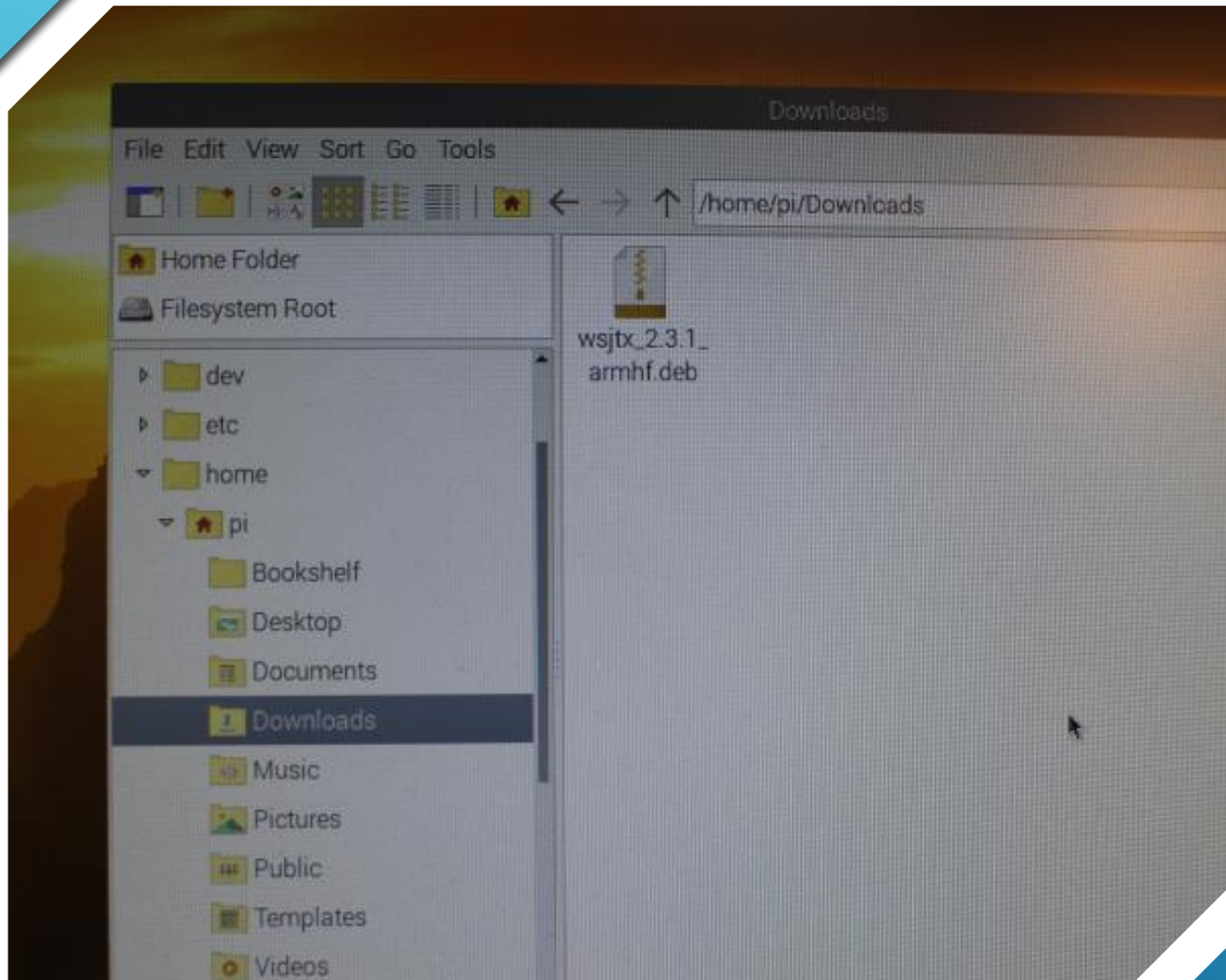
INSTALL WSJT-X

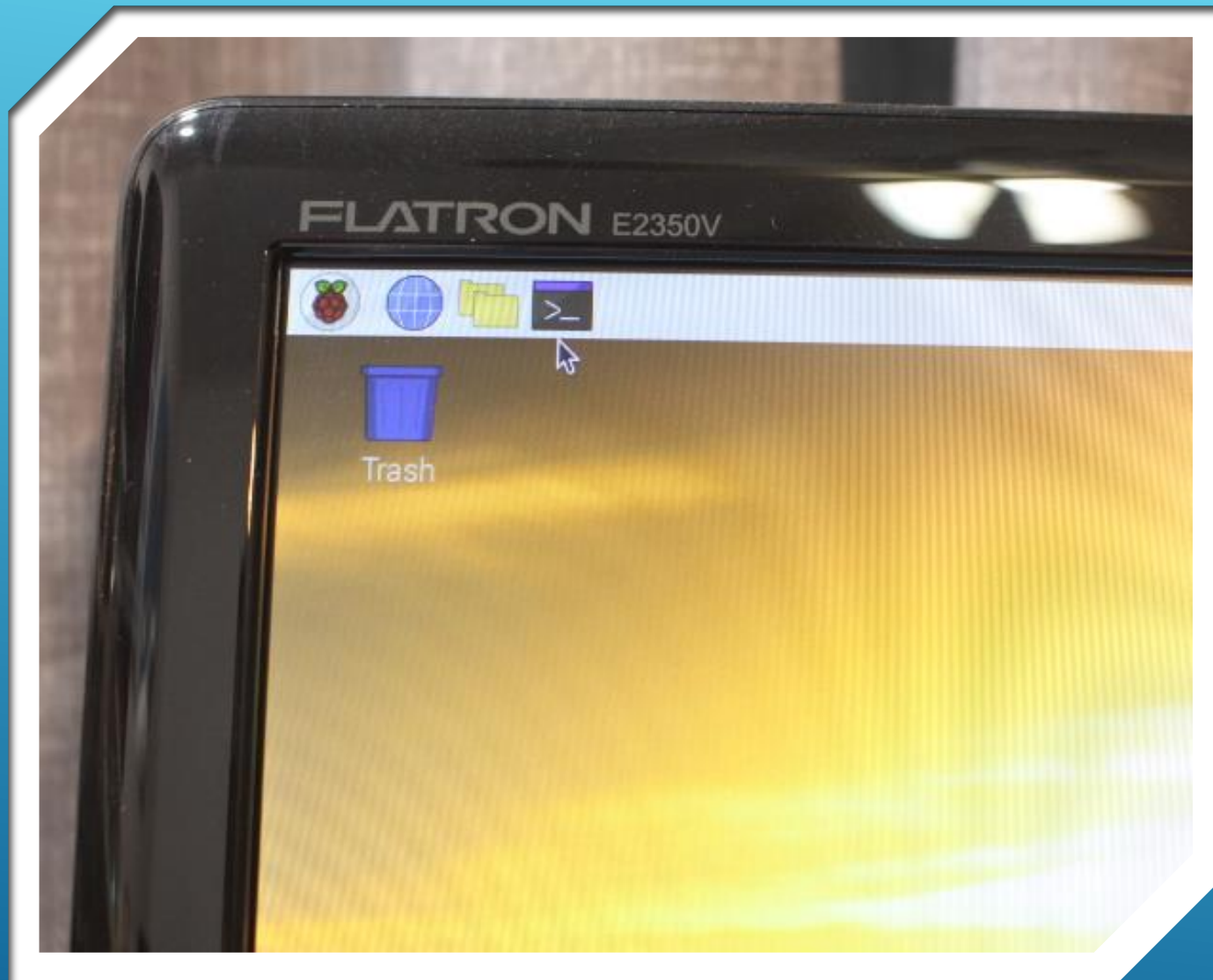
- ▶ Open the “Downloads” Folder



INSTALL WSJT-X

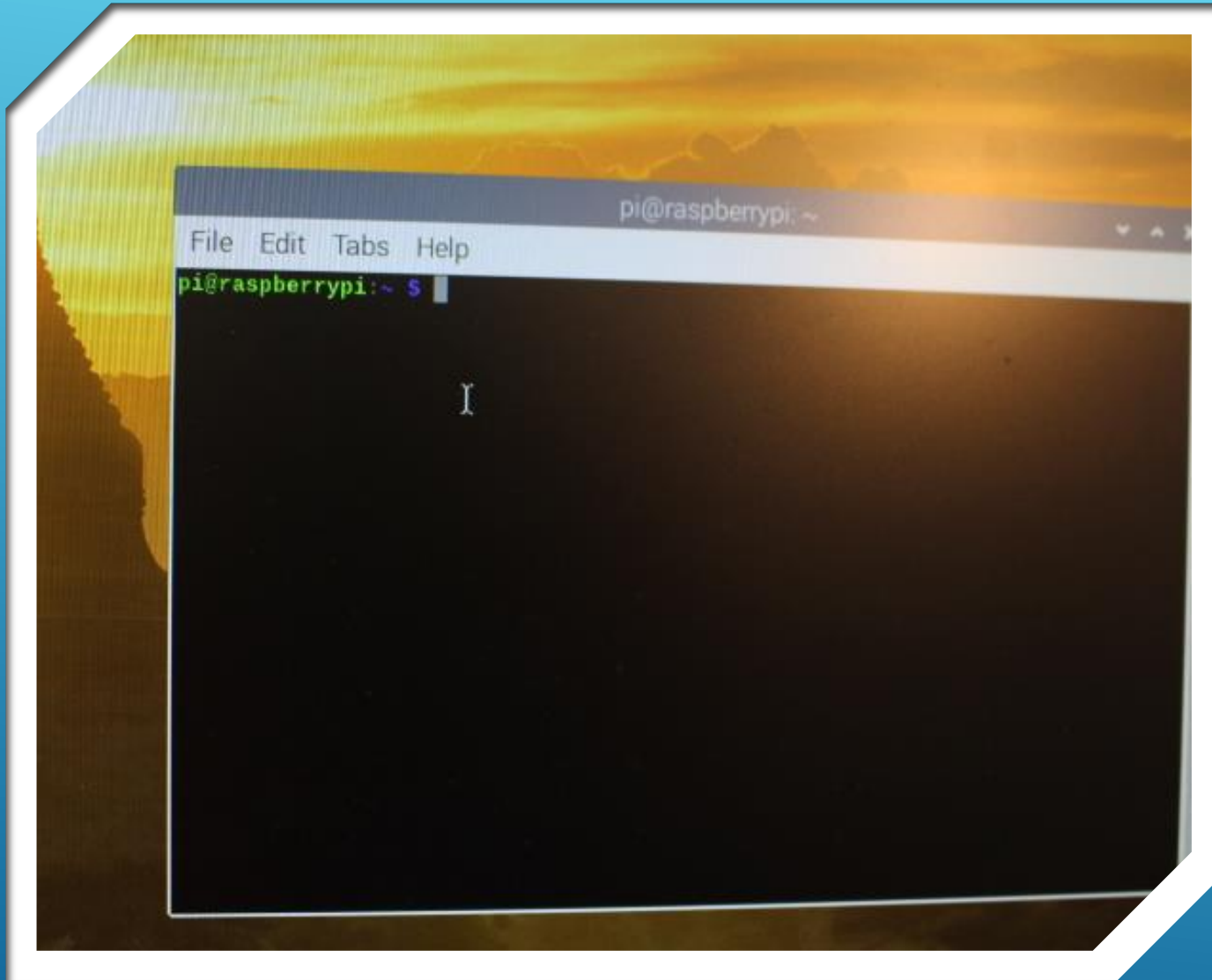
- ▶ If you see the **wsjtx_2.3.1_armhf_deb** zipped folder in the Downloads file, the package download was successful.
- ▶ At this point you are ready to load the wsjtx software onto your device.
- ▶ Close “X” out of this screen and...
- ▶ Read on...





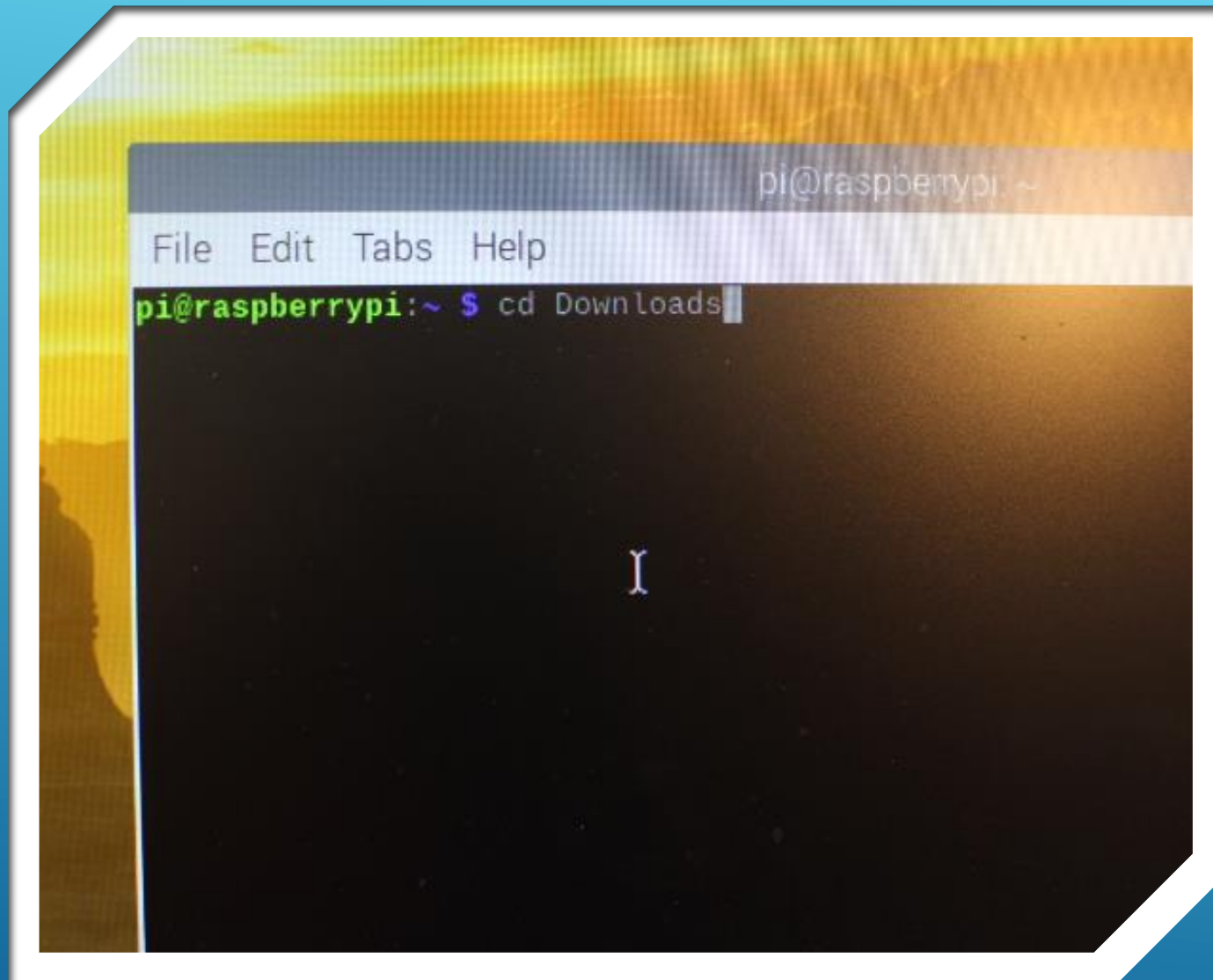
INSTALL WSJT-X

- ▶ Click this icon on the Menu Bar to enter desktop Terminal Mode.
- ▶ From the “Terminal” screen you will type in and enter specific commands to load the “wsjt-x” program onto your raspberry pi 4 device.



INSTALL WSJT-X

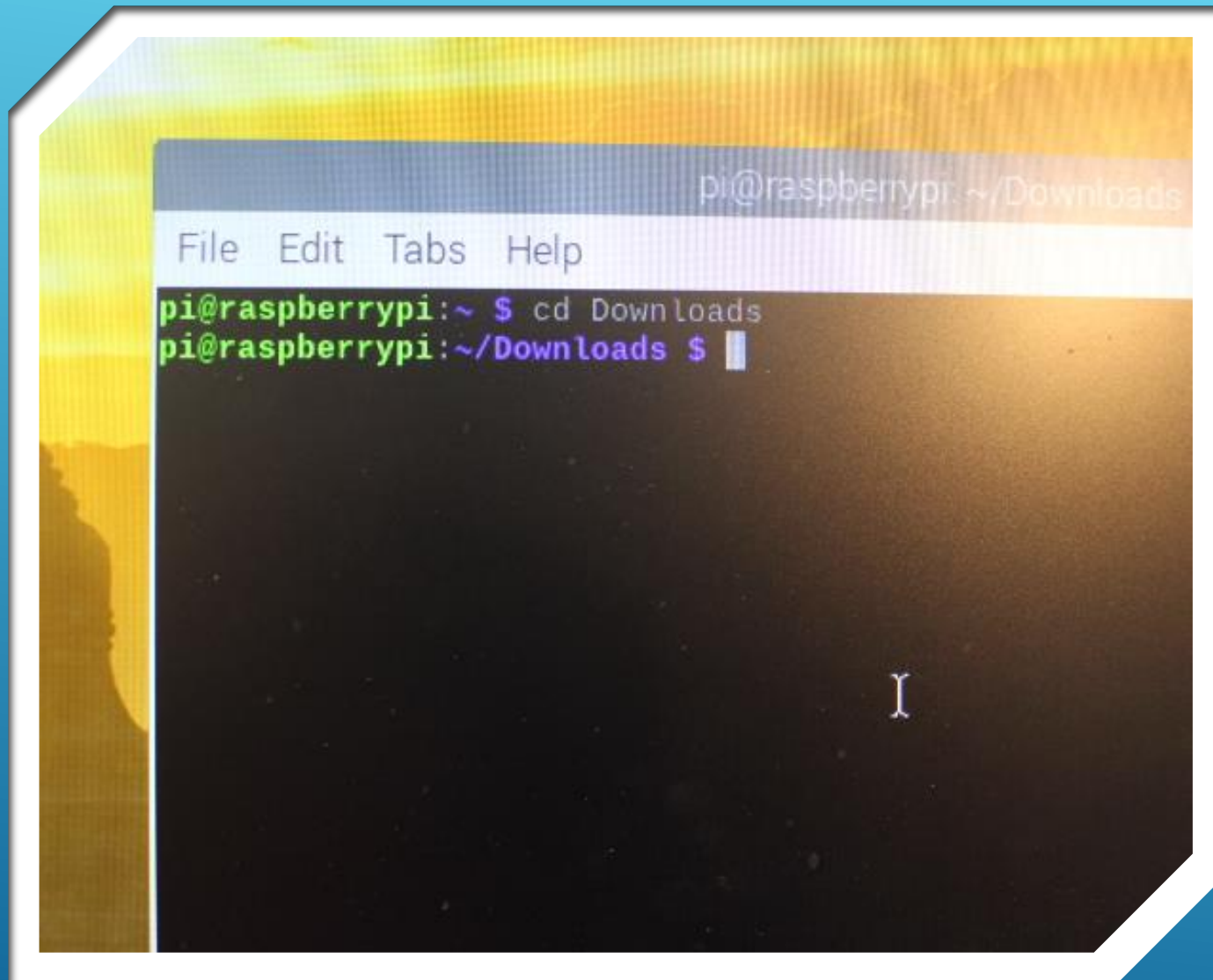
- ▶ The following prompt will be displayed on your screen.
- ▶ This indicates you are currently in the "raspberrypi": root directory.
- ▶ The directory holding the wsjtx folder is named, "Downloads" (which you just saw in an earlier slide).
- ▶ The "CD" command will be used to "change directory" to the one specified next.

A screenshot of a terminal window on a Raspberry Pi. The window title is 'pi@raspberrypi ~'. The menu bar shows 'File Edit Tabs Help'. The prompt is 'pi@raspberrypi:~ \$' and the command 'cd Downloads' is being entered. A cursor is visible at the end of the command.

```
pi@raspberrypi ~
File Edit Tabs Help
pi@raspberrypi:~ $ cd Downloads
```

INSTALL WSJT-X

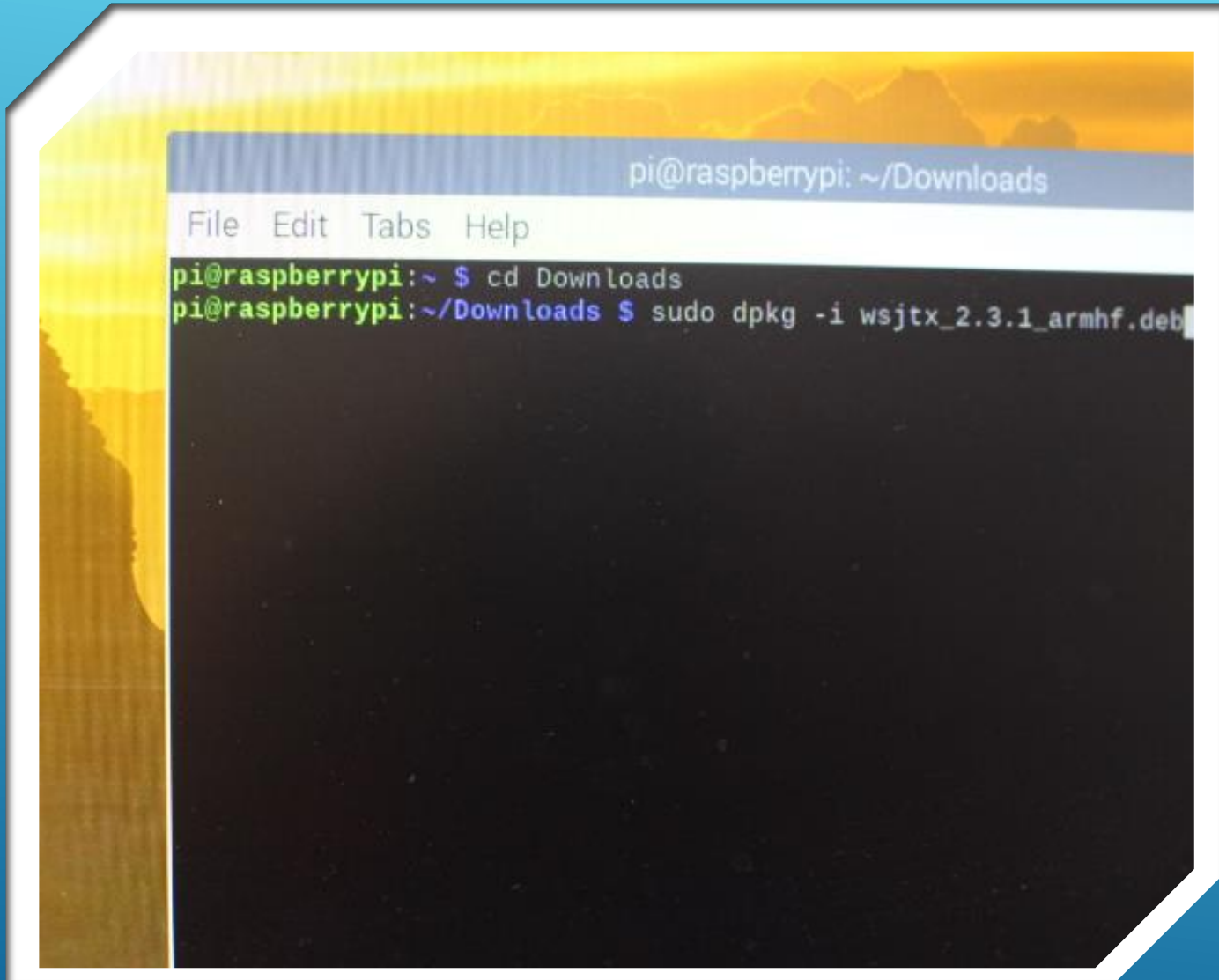
- ▶ Type the following **EXACTLY** as shown and press Enter:
- ▶ `cd Downloads`
- ▶ **Note:** Be sure the word “Downloads” is capitalized as this is how the name of the directory is actually spelled. If you use all lower case, you will get an error message.

A terminal window on a Raspberry Pi. The window title is 'pi@raspberrypi: ~/Downloads'. The menu bar shows 'File Edit Tabs Help'. The terminal text shows the user entering 'cd Downloads' and the prompt changing to 'pi@raspberrypi:~/Downloads \$'.

```
pi@raspberrypi: ~/Downloads
File Edit Tabs Help
pi@raspberrypi:~ $ cd Downloads
pi@raspberrypi:~/Downloads $
```

INSTALL WSJT-X

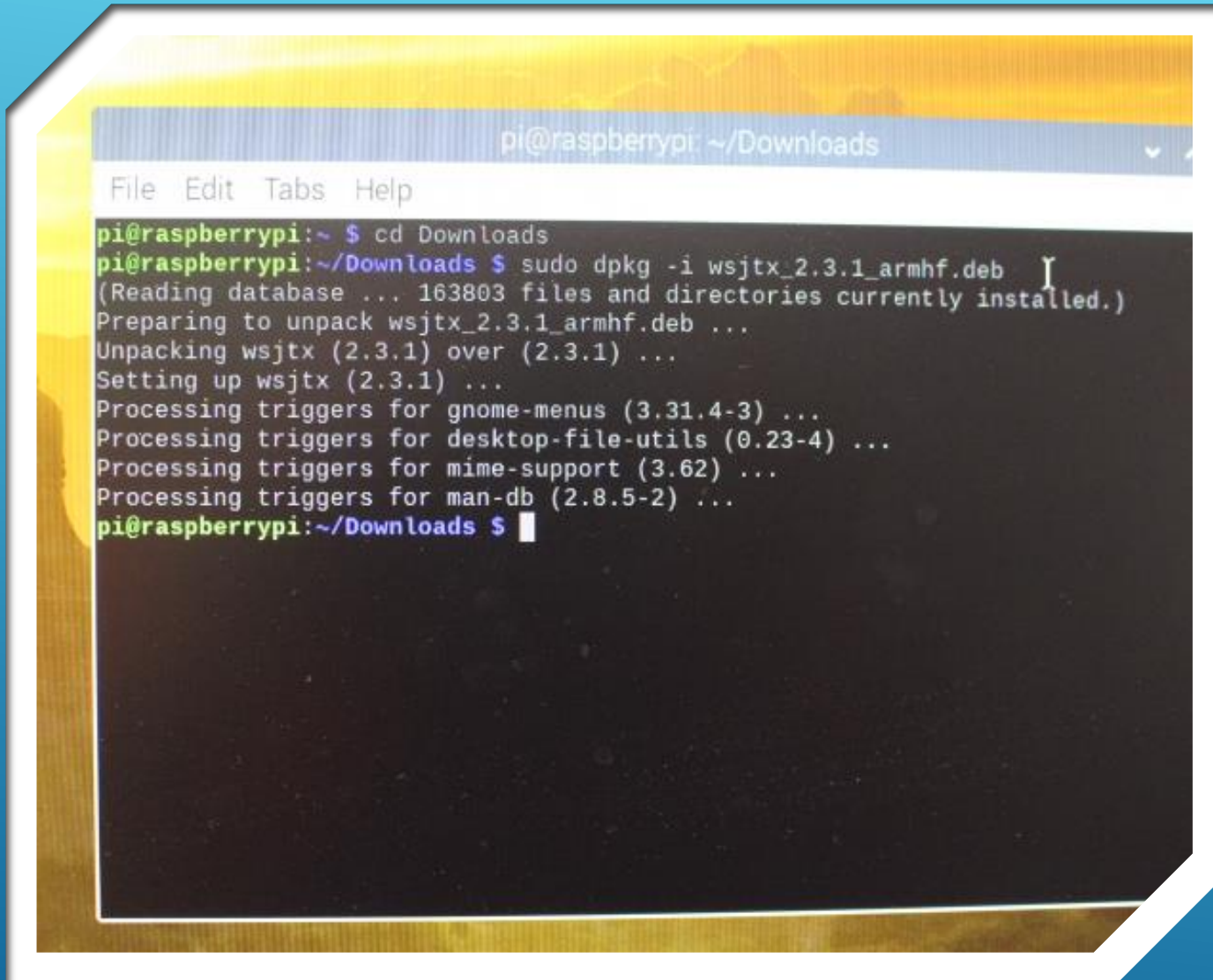
- ▶ The screen prompt is now coming from the “Downloads” directory.
- ▶ Proceed to the next slide...

A terminal window on a Raspberry Pi. The title bar shows 'pi@raspberrypi: ~/Downloads'. The menu bar includes 'File Edit Tabs Help'. The terminal text shows the user navigating to the Downloads directory and running the command 'sudo dpkg -i wsjtx_2.3.1_armhf.deb'.

```
pi@raspberrypi: ~/Downloads
File Edit Tabs Help
pi@raspberrypi:~ $ cd Downloads
pi@raspberrypi:~/Downloads $ sudo dpkg -i wsjtx_2.3.1_armhf.deb
```

INSTALL WSJT-X

- ▶ Type the following EXACTLY as shown and press Enter:
- ▶ `sudo dpkg -i wsjtx_2.3.1_armhf.deb`

A terminal window on a Raspberry Pi showing the installation of the wsjtx_2.3.1_armhf.deb package. The window title is 'pi@raspberrypi: ~/Downloads'. The terminal output shows the command 'sudo dpkg -i wsjtx_2.3.1_armhf.deb' being executed, followed by several lines of progress information: '(Reading database ... 163803 files and directories currently installed.)', 'Preparing to unpack wsjtx_2.3.1_armhf.deb ...', 'Unpacking wsjtx (2.3.1) over (2.3.1) ...', 'Setting up wsjtx (2.3.1) ...', and 'Processing triggers for gnome-menus (3.31.4-3) ...', 'Processing triggers for desktop-file-utils (0.23-4) ...', 'Processing triggers for mime-support (3.62) ...', and 'Processing triggers for man-db (2.8.5-2) ...'. The terminal ends with a new prompt 'pi@raspberrypi:~/Downloads \$' and a cursor.

```
pi@raspberrypi:~/Downloads
File Edit Tabs Help
pi@raspberrypi:~ $ cd Downloads
pi@raspberrypi:~/Downloads $ sudo dpkg -i wsjtx_2.3.1_armhf.deb
(Reading database ... 163803 files and directories currently installed.)
Preparing to unpack wsjtx_2.3.1_armhf.deb ...
Unpacking wsjtx (2.3.1) over (2.3.1) ...
Setting up wsjtx (2.3.1) ...
Processing triggers for gnome-menus (3.31.4-3) ...
Processing triggers for desktop-file-utils (0.23-4) ...
Processing triggers for mime-support (3.62) ...
Processing triggers for man-db (2.8.5-2) ...
pi@raspberrypi:~/Downloads $
```

INSTALL WSJT-X

- ▶ The screen will display all the processes occurring as the command is executed. When the process has completed you will see a new command prompt as shown.
- ▶ Next slide...

```
pi@raspberrypi: ~/Downloads
File Edit Tabs Help
pi@raspberrypi:~ $ cd Downloads
pi@raspberrypi:~/Downloads $ sudo dpkg -i wsjtx_2.3.1_armhf.deb
(Reading database ... 163803 files and directories currently installed.)
Preparing to unpack wsjtx_2.3.1_armhf.deb ...
Unpacking wsjtx (2.3.1) over (2.3.1) ...
Setting up wsjtx (2.3.1) ...
Processing triggers for gnome-menus (3.31.4-3) ...
Processing triggers for desktop-file-utils (0.23-4) ...
Processing triggers for mime-support (3.62) ...
Processing triggers for man-db (2.8.5-2) ...
pi@raspberrypi:~/Downloads $ sudo apt-get --fix-broken install
```

INSTALL WSJT-X

- ▶ After the command prompt type in the following EXACTLY as shown, then press ENTER.
- ▶ `sudo apt-get --fix-broken install`
- ▶ Next slide...

pi@raspberrypi: ~/Downloads

File Edit Tabs Help

```
pi@raspberrypi:~ $ cd Downloads
pi@raspberrypi:~/Downloads $ sudo dpkg -i wsjtx_2.3.1_armhf.deb
(Reading database ... 163803 files and directories currently installed)
Preparing to unpack wsjtx_2.3.1_armhf.deb ...
Unpacking wsjtx (2.3.1) over (2.3.1) ...
Setting up wsjtx (2.3.1) ...
Processing triggers for gnome-menus (3.31.4-3) ...
Processing triggers for desktop-file-utils (0.23-4) ...
Processing triggers for mime-support (3.62) ...
Processing triggers for man-db (2.8.5-2) ...
pi@raspberrypi:~/Downloads $ sudo apt-get --fix-broken install
Reading package lists... Done
Building dependency tree
Reading state information... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
pi@raspberrypi:~/Downloads $ █
```

INSTALL WSJT-X

- ▶ Again, the screen will display the resulting processes as each one is executed by the command you entered.
- ▶ When the command has been fully executed a new command prompt will be presented.
- ▶ We're almost done.
- ▶ Next slide...

pi@raspberrypi:~/Downloads

File Edit Tabs Help

```
pi@raspberrypi:~ $ cd Downloads
pi@raspberrypi:~/Downloads $ sudo dpkg -i wsjtx_2.3.1_armhf.deb
(Reading database ... 163803 files and directories currently installed.)
Preparing to unpack wsjtx_2.3.1_armhf.deb ...
Unpacking wsjtx (2.3.1) over (2.3.1) ...
Setting up wsjtx (2.3.1) ...
Processing triggers for gnome-menus (3.31.4-3) ...
Processing triggers for desktop-file-utils (0.23-4) ...
Processing triggers for mime-support (3.62) ...
Processing triggers for man-db (2.8.5-2) ...
pi@raspberrypi:~/Downloads $ sudo apt-get --fix-broken install
Reading package lists... Done
Building dependency tree
Reading state information... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
pi@raspberrypi:~/Downloads $ sudo dpkg -i wsjtx_2.3.1_armhf.deb
```

I

INSTALL WSJT-X

- ▶ Lastly, type in the following command line EXACTLY as shown, and press ENTER:
- ▶ `sudo dpkg -i wsjtx_2.3.1_armhf.deb`

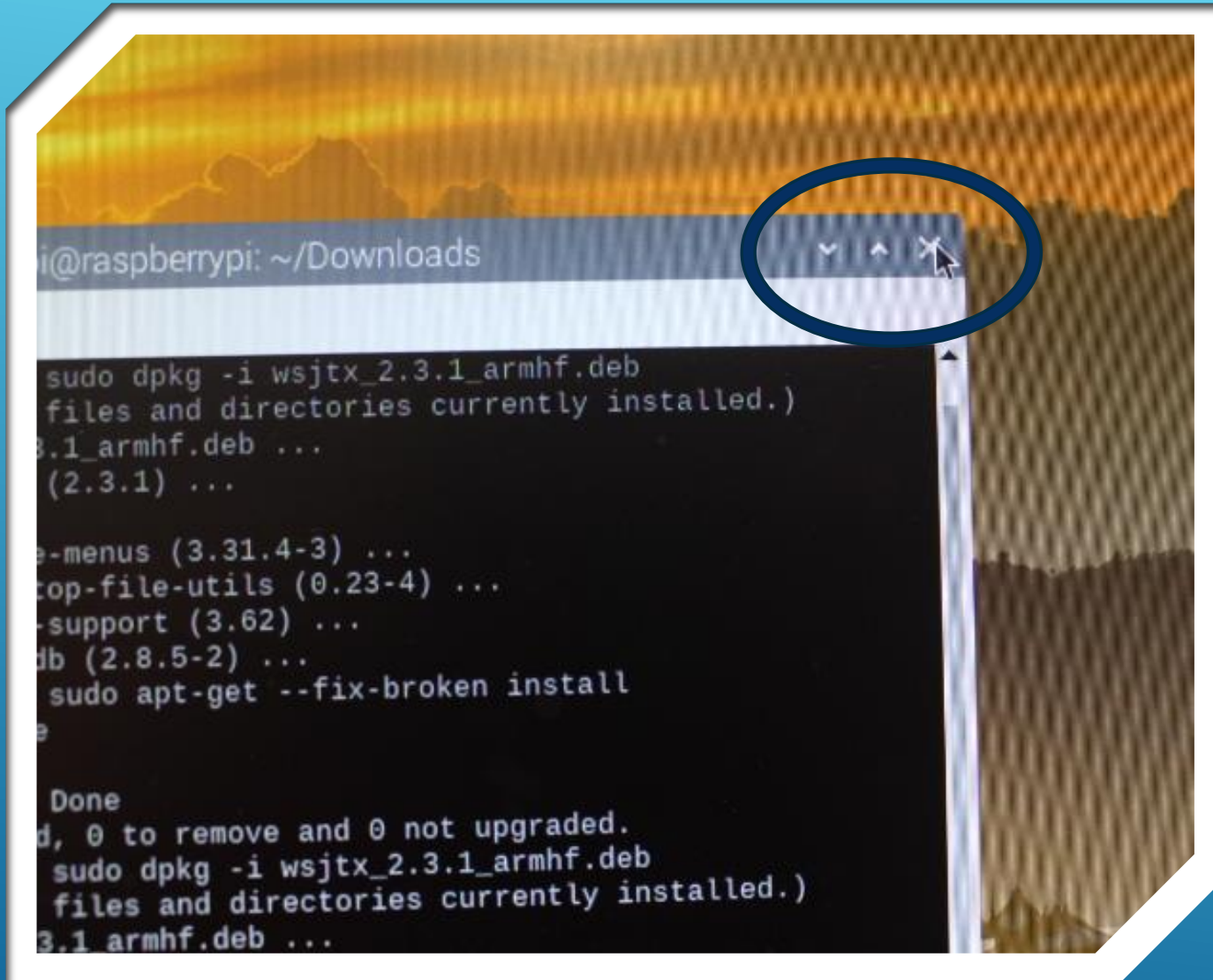
```
pi@raspberrypi:~/Downloads
File Edit Tabs Help
pi@raspberrypi:~/Downloads $ sudo dpkg -i wsjtx_2.3.1_armhf.deb
(Reading database ... 163803 files and directories currently installed.)
Preparing to unpack wsjtx_2.3.1_armhf.deb ...
Unpacking wsjtx (2.3.1) over (2.3.1) ...
Setting up wsjtx (2.3.1) ...
Processing triggers for gnome-menus (3.31.4-3) ...
Processing triggers for desktop-file-utils (0.23-4) ...
Processing triggers for mime-support (3.62) ...
Processing triggers for man-db (2.8.5-2) ...
pi@raspberrypi:~/Downloads $ sudo apt-get --fix-broken install
Reading package lists... Done
Building dependency tree
Reading state information... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
pi@raspberrypi:~/Downloads $ sudo dpkg -i wsjtx_2.3.1_armhf.deb
(Reading database ... 163803 files and directories currently installed.)
Preparing to unpack wsjtx_2.3.1_armhf.deb ...
Unpacking wsjtx (2.3.1) over (2.3.1) ...
Setting up wsjtx (2.3.1) ...
Processing triggers for gnome-menus (3.31.4-3) ...
Processing triggers for desktop-file-utils (0.23-4) ...
Processing triggers for mime-support (3.62) ...
Processing triggers for man-db (2.8.5-2) ...
pi@raspberrypi:~/Downloads $
```

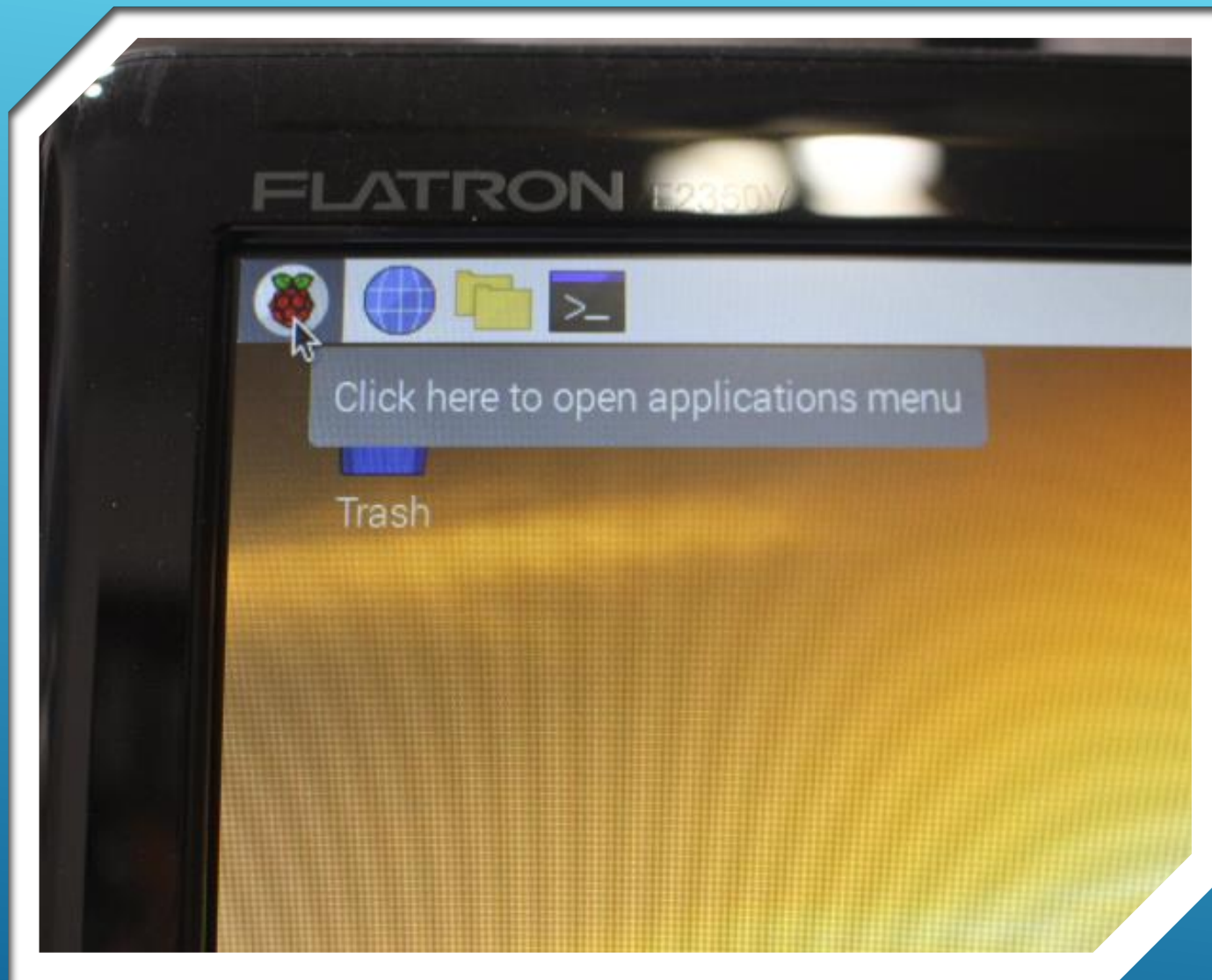
INSTALL WSJT-X

- ▶ When all command processes have been executed the screen (once again) will display a new command prompt.
- ▶ At this point, you are done inputting terminal commands.
- ▶ Next slide...

INSTALL WSJT-X

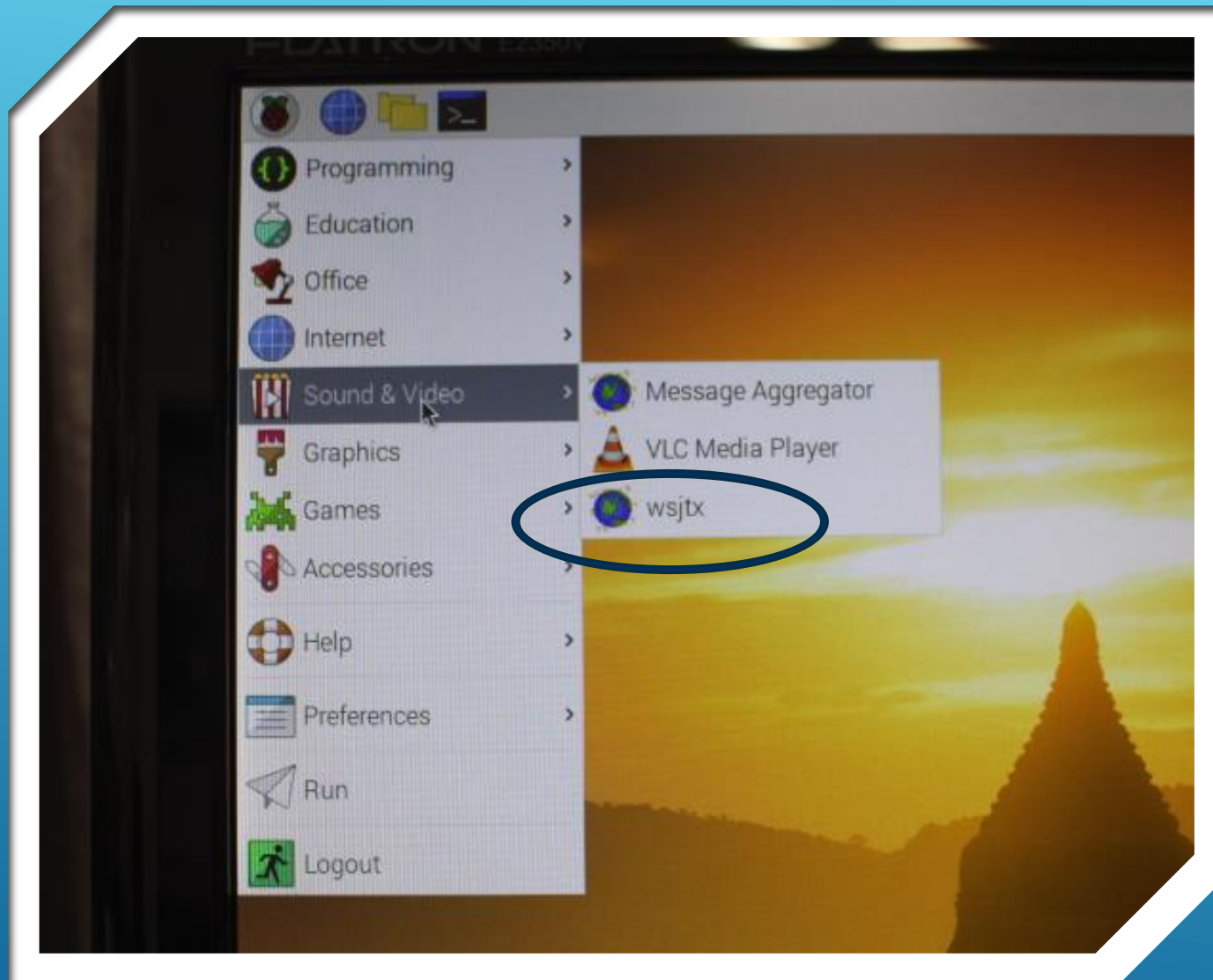
- ▶ You can now “X” or close out of Terminal Mode.
- ▶ WSJT-X should now be available on your device, ready to choose from the menu screen.
- ▶ Let’s verify...
- ▶ Next slide...





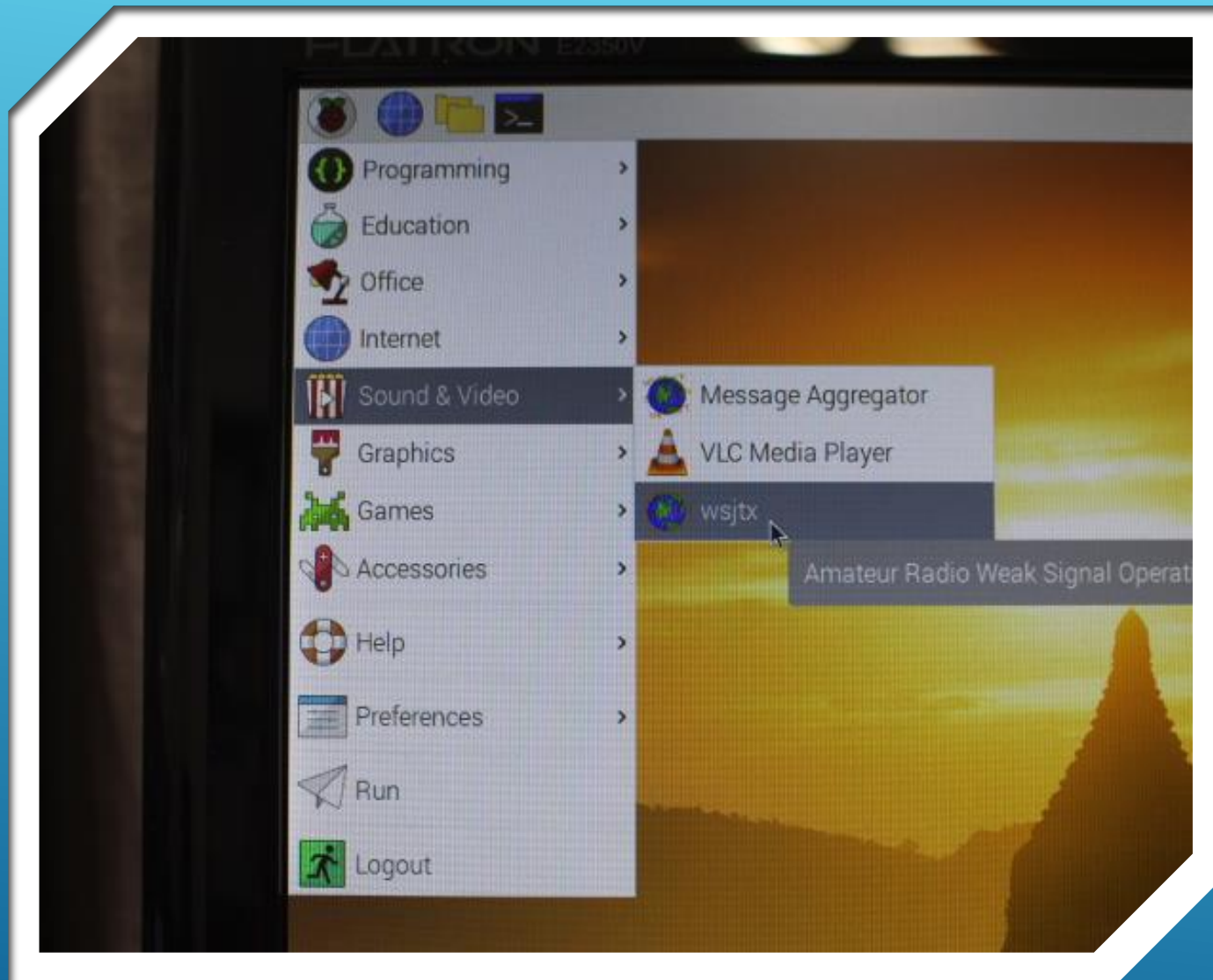
INSTALL WSJT-X

- ▶ Open the Applications Menu



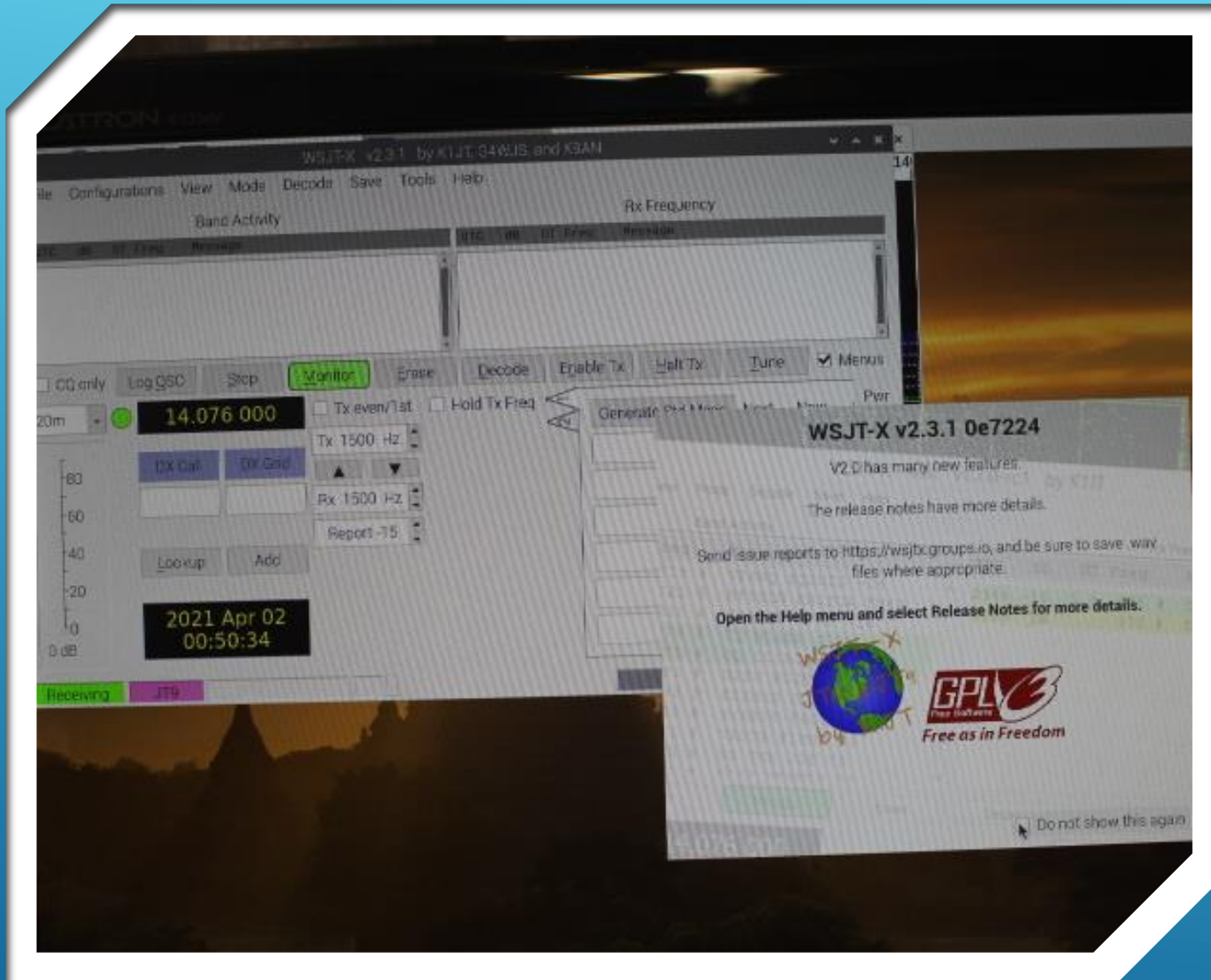
INSTALL WSJT-X

- ▶ Select the “Sounds & Video” bar
- ▶ You should now to see the “wsjtx” menu option.
- ▶ This is where you will start up the program to use FT8 and other digital modes with your radio



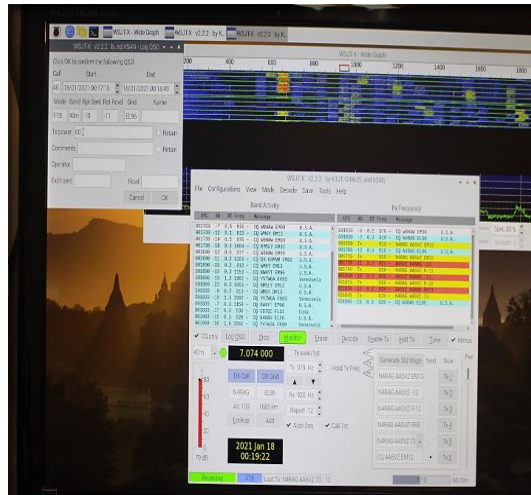
INSTALL WSJT-X

- ▶ Click on the “wsjtx” icon.



INSTALL WSJT-X

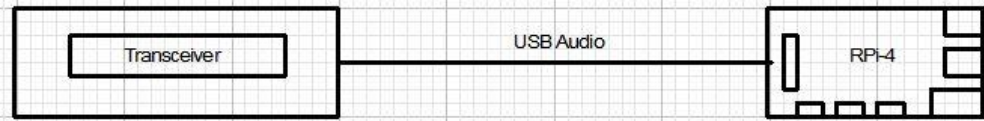
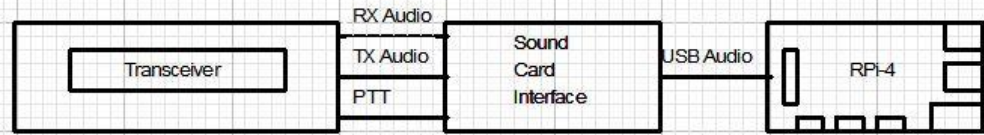
- ▶ The WSJT-X program should open.
- ▶ If it does, **CONGRATULATIONS!**
- ▶ **This would be a great time to log-off, shut down and back up your SD Card.**
- ▶ Take a break...You deserve it!
- ▶ We'll return later...



THE INTERFACE

- ▶ Install WSJT-X (FT-8, JT-65, and others)
- ▶ Interface the Pi-4 to your Radio
 - ▶ Audio Sound Card
 - ▶ Direct (USB)
- ▶ Configure the Apps
- ▶ Configure your radio
- ▶ Get on the Air
- ▶ Have Fun!

THE INTERFACE



Radio to Pi Interface Configurations

- ▶ Top diagram
- ▶ Very common with older radios
- ▶ Uses a USB Sound Card Interface
 - ▶ Tx/Rx Audio + PTT connections to radio
 - ▶ USB Audio Connection to Rpi-4
- ▶ Example: Kenwood TS-940
- ▶ *****
- ▶ Bottom diagram
- ▶ Newer radios provide this type of connectivity
 - ▶ No Sound Card Interface Device
 - ▶ USB Direct Connection / Pi to Radio
- ▶ Example: Kenwood TS-590

THE INTERFACE

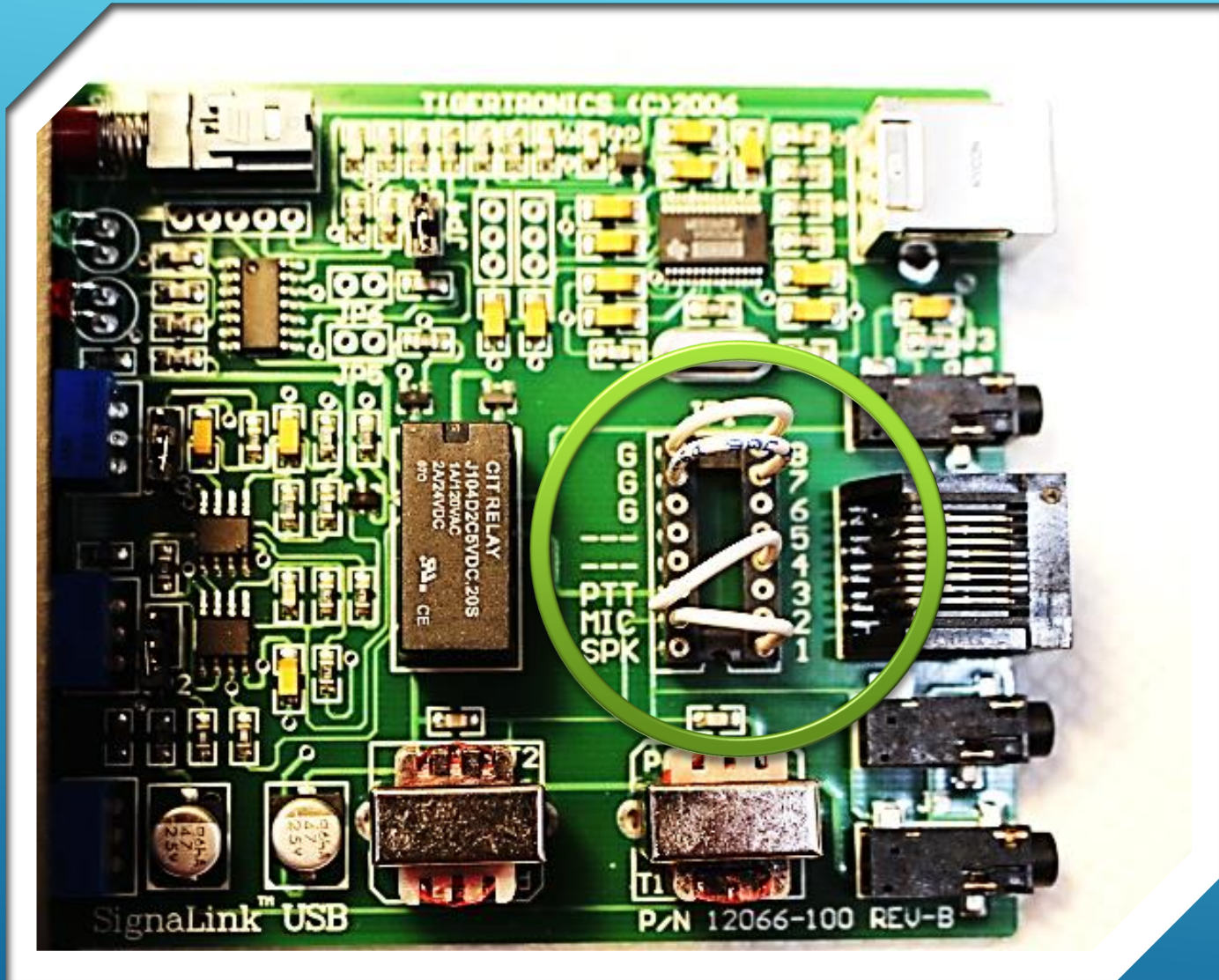
- Numerous products available by various manufacturers.
 - Tigertronics Signalink
 - West Mountain Radio
 - Rig Expert
 - MFJ
 - others
- I currently use Tigertronics Signalink USB which will be used for descriptive purposes here.





THE INTERFACE

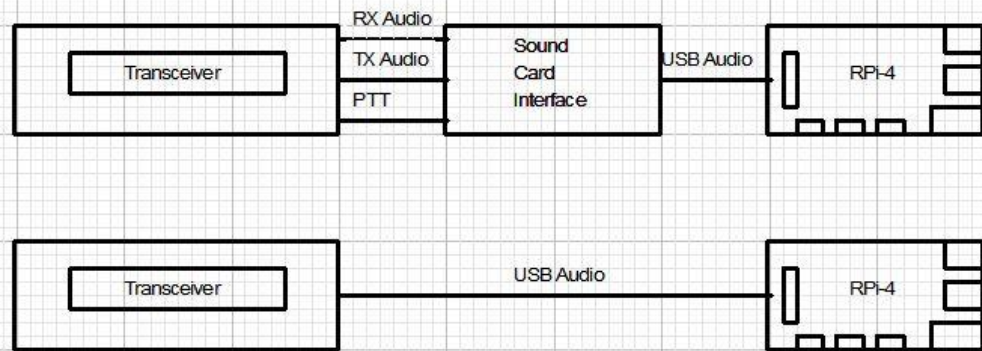
- Refer to device User Manual
- <https://www.tigertronics.com/slusbmain.htm>
- **USB:**
- Connects to USB on R-Pi
- **RADIO:**
- Connects to Mic or ACC plug on radio
- **SPKR:**
- Connects to Ext. Spkr. or Audio Out on Radio



THE INTERFACE

- ▶ Refer to device User Manual
- ▶ <https://www.tigertronics.com/slusbmain.htm>
- ▶ Depending on the type of interface used it may be necessary to configure internal jumpers or add a jumper plug that conforms to the type of cable and radio you are using.
- ▶ This is the configuration I use for my Kenwood TS-940 radio.

CONFIGURE THE RADIO FOR WSJT-X



Radio to Pi Interface Configurations

- ▶ Decide on an interface method
- ▶ Top diagram:
 - ▶ Very common with older radios
 - ▶ Uses a USB Sound Card Interface
 - ▶ Tx/Rx Audio + PTT connections to radio
 - ▶ Uses Mic and Spkr. Connectors
 - ▶ or ACC connector
 - ▶ USB Audio Connection to Rpi-4
- ▶ Ex: Kenwood TS-940
- ▶ Bottom diagram:
 - ▶ Newer radios provide this type of connectivity
 - ▶ No Sound Card Interface Device
 - ▶ USB Direct Connection / Pi to Radio
- ▶ Ex: Kenwood TS-590 / Icom IC-7300



- ▶ Refer to Instruction Manual for the Radio You are Using
- ▶ Connect USB Sound Card “Radio” Cable to Radio’s MIC Input
- ▶ Connect USB Sound Card SPKR Cable to Radio’s EXT SPKR
- ▶ Alt. Method – Connect USB Sound Card to your Radio’s ACC connector using appropriate cable
- ▶ On Radio, ensure VOX is enabled
- ▶ Use TX and RX Controls on USB Sound Card in conjunction with microphone and speaker settings on your radio to establish “optimum” audio levels. This is a bit of a balancing act.

CONFIGURE A RADIO FOR FT8 USING SOUND CARD INTERFACE



- ▶ Typical settings for modern radios follow...
- ▶ Refer to Instruction Manual for the Radio You are Using
- ▶ Connect USB Cable from Rpi-4 to Radio USB Port
- ▶ Go to MENU settings
- ▶ Set Audio Input Line Selection to "USB"

CONFIGURE A RADIO FOR FT8 USING
A DIRECT USB CONNECTION



- ▶ Refer to Instruction Manual for the Radio You are Using
- ▶ Set a USB INPUT LEVEL value for Data Communications

CONFIGURE A RADIO FOR FT8 USING A DIRECT USB CONNECTION



- ▶ Refer to Instruction Manual for the Radio You are Using
- ▶ Set a USB OUTPUT LEVEL value for Data Communications

CONFIGURE A RADIO FOR FT8 USING
A DIRECT USB CONNECTION



- ▶ Refer to Instruction Manual for the Radio You are Using
- ▶ Set a USB VOX level for Data Communications use

CONFIGURE A RADIO FOR FT8 USING
A DIRECT USB CONNECTION



- ▶ Refer to Instruction Manual for the Radio You are Using
- ▶ Set the correct BAUD RATE for the radio USB Port

CONFIGURE A RADIO FOR FT8 USING
A DIRECT USB CONNECTION

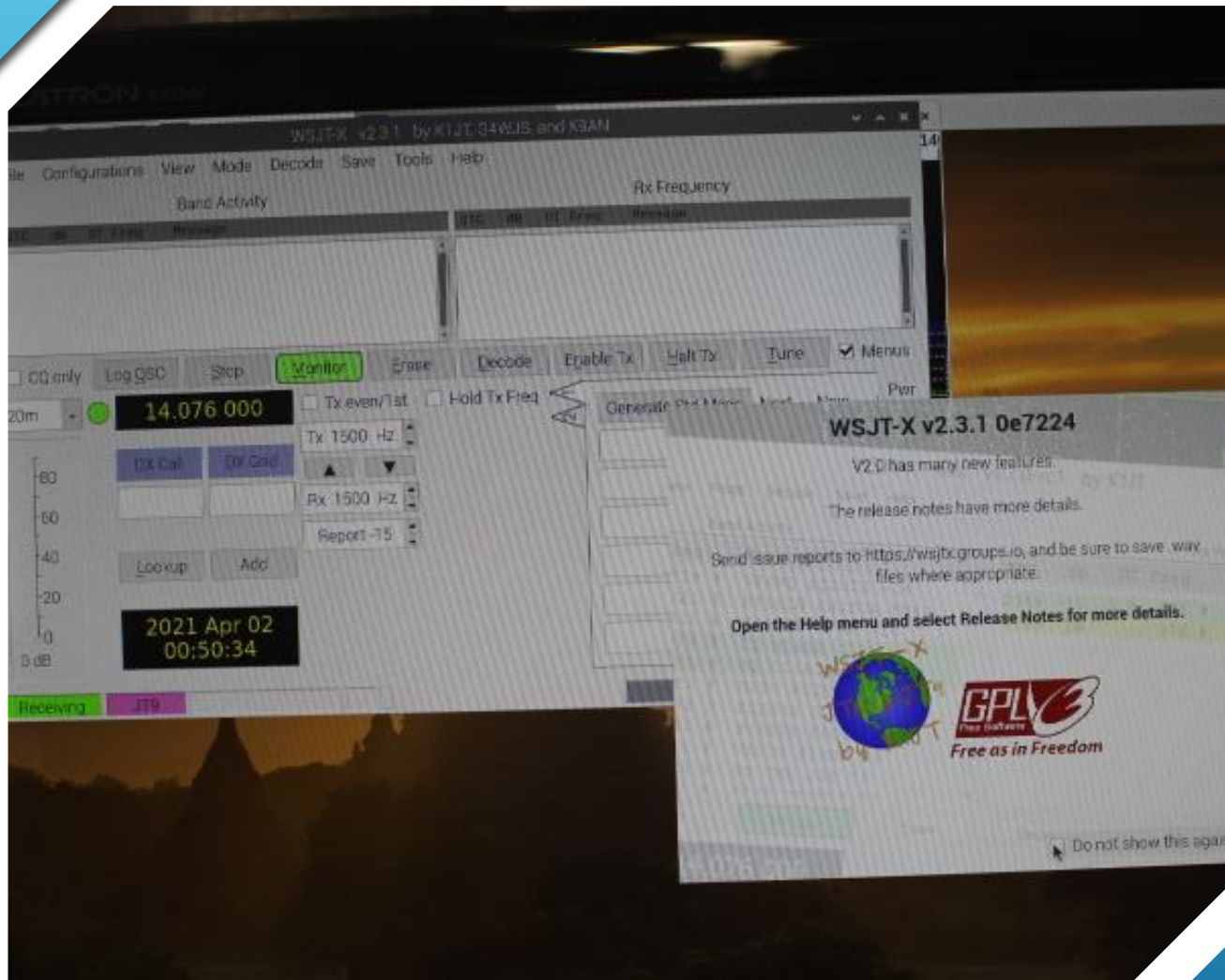


- ▶ Refer to Instruction Manual for the radio you are using.
- ▶ Be sure selected frequency for FT8 on radio and on the R-Pi WSJT-X control panel correspond.

CONFIGURE A RADIO FOR FT8 USING A DIRECT USB CONNECTION

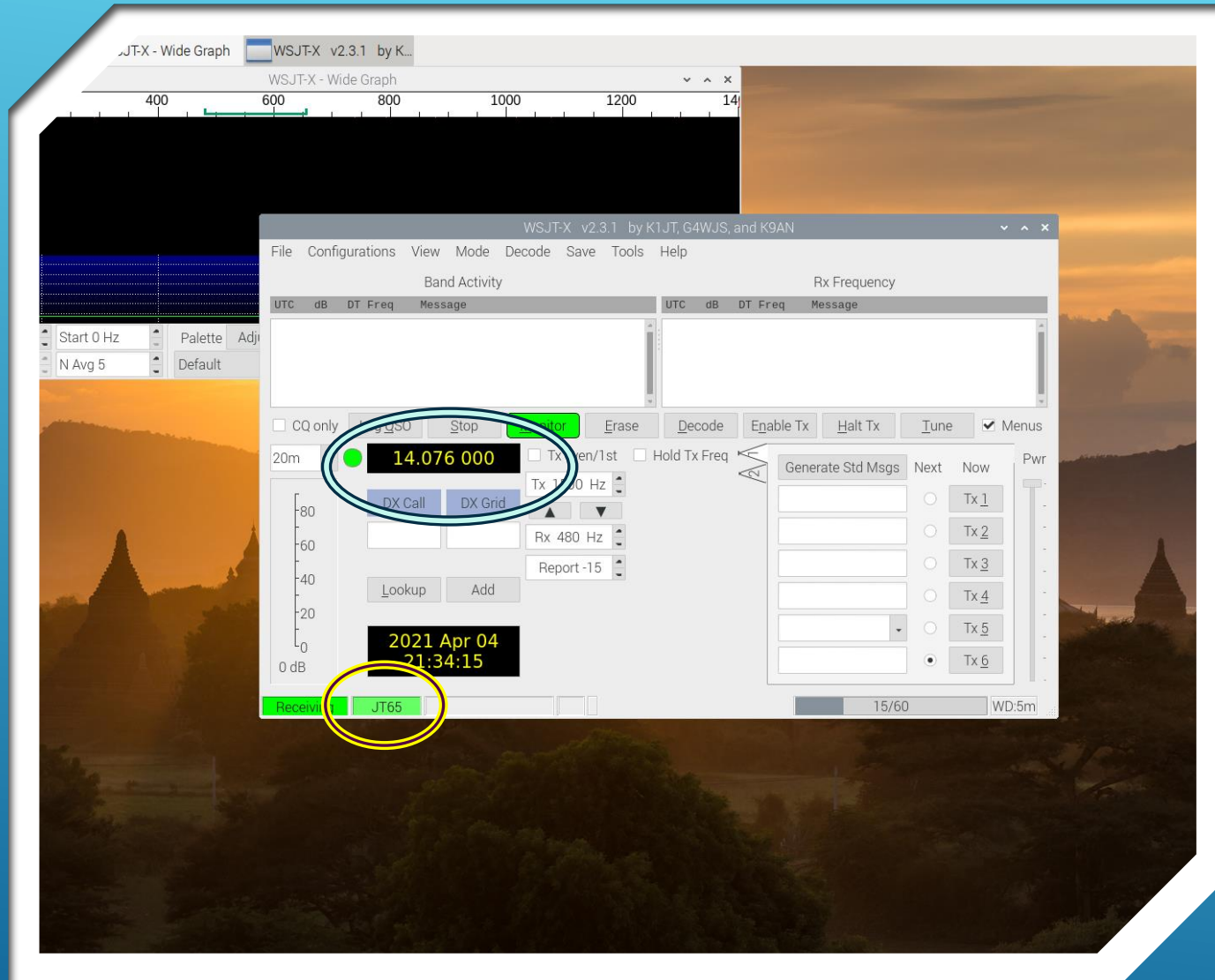
CONFIGURE WSJT-X FOR FT-8 OPERATION

- ▶ Connect Radio to R-Pi using appropriate Interface
- ▶ Use Dummy Load during initial configuration and testing
- ▶ Turn on Radio
- ▶ Start Up the Raspberry Pi
- ▶ Power Up the Sound Card Interface (if used)
- ▶ Open WSJT-X program
- ▶ Waterfall and Control Screens overlap.



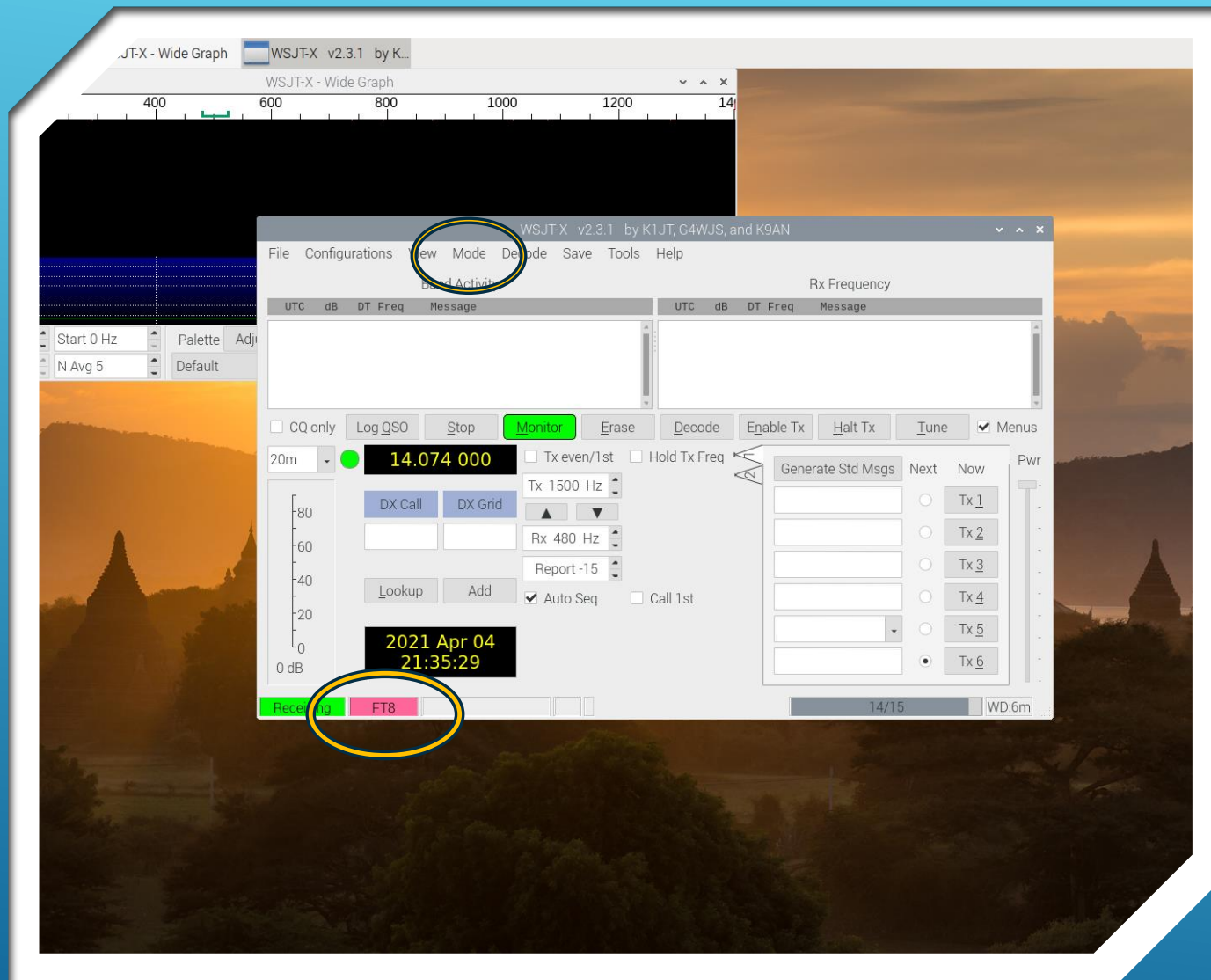
CONFIGURE WSJT-X FOR FT-8 OPERATION

- ▶ Position windows accordingly for now.
- ▶ Program initially starts in JT65 mode, 14.076Mhz displayed.



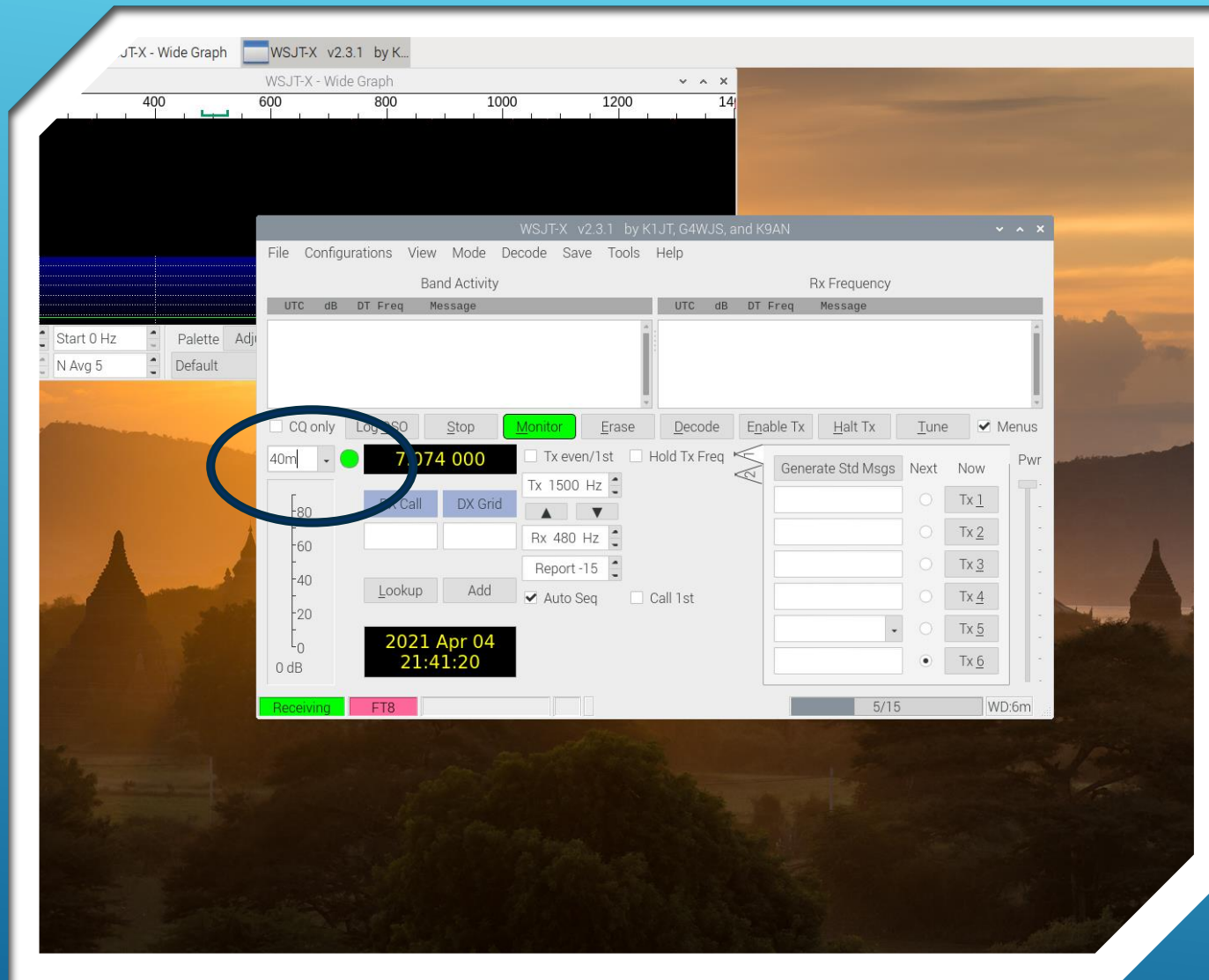
CONFIGURE WSJT-X FOR FT-8 OPERATION

- ▶ Change operating mode by clicking “Mode” on menu tab, then select “FT8” from the drop-down list.
- ▶ Control screen is now set to FT-8 mode with corresponding frequency (14.074 MHz) for the band indicated (20m).
- ▶ Once set, program will always re-open to the mode and band used last.



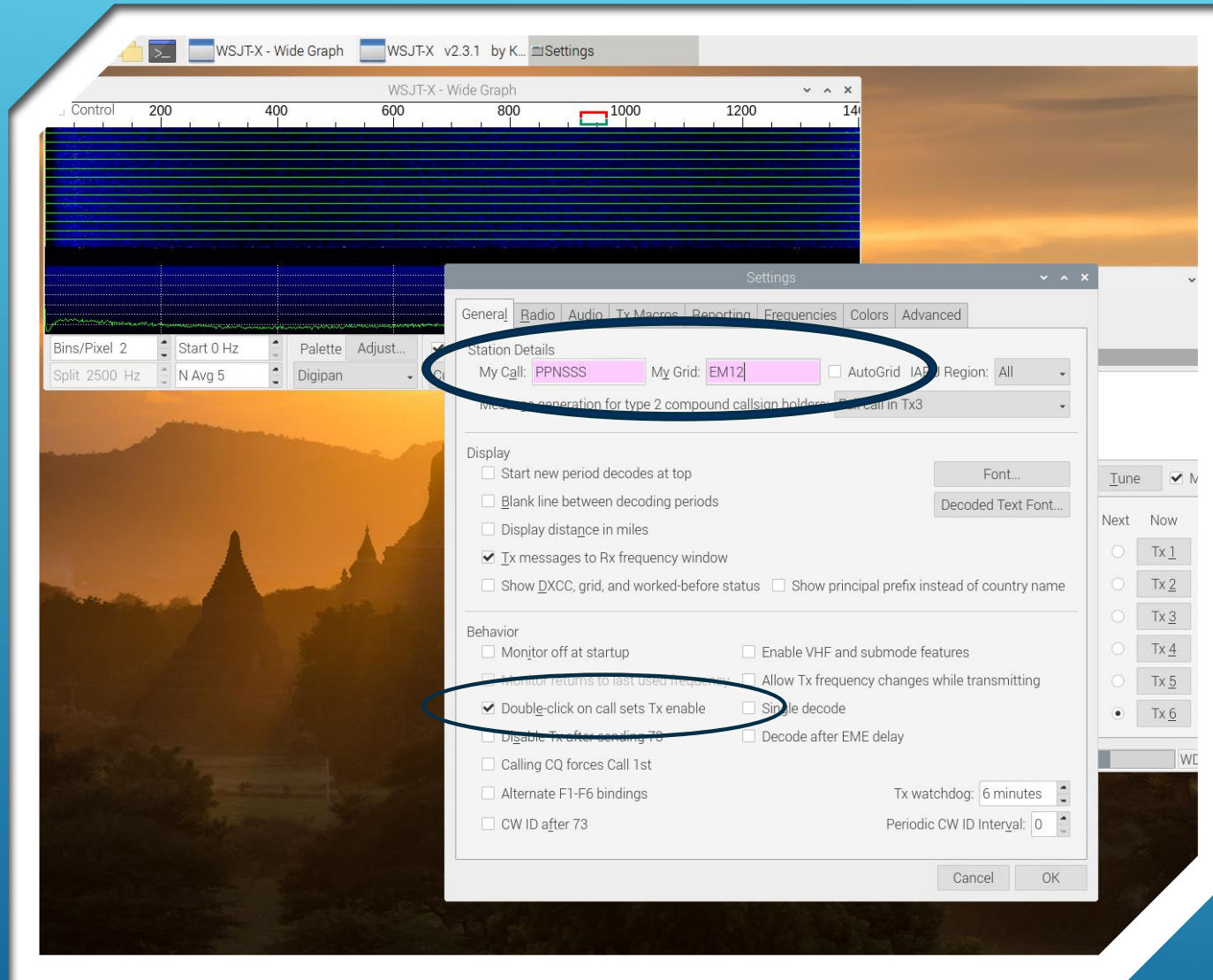
CONFIGURE WSJT-X FOR FT-8 OPERATION

- ▶ To change the WSJT operating band, click on the band selection arrow and select the desired operating frequency from the list.
- ▶ The new operating band and corresponding operational frequency will be indicated.
- ▶ **NOTE:** You must separately adjust the controls on your radio to transmit and receive on the band and mode operating frequency you plan to use. The configuration settings discussed here are the “matching” modes and frequencies the WSJT program uses to operate and log your FT-8 contacts.
- ▶ Advanced rig control features are available within WSJT but will not be attempted here.



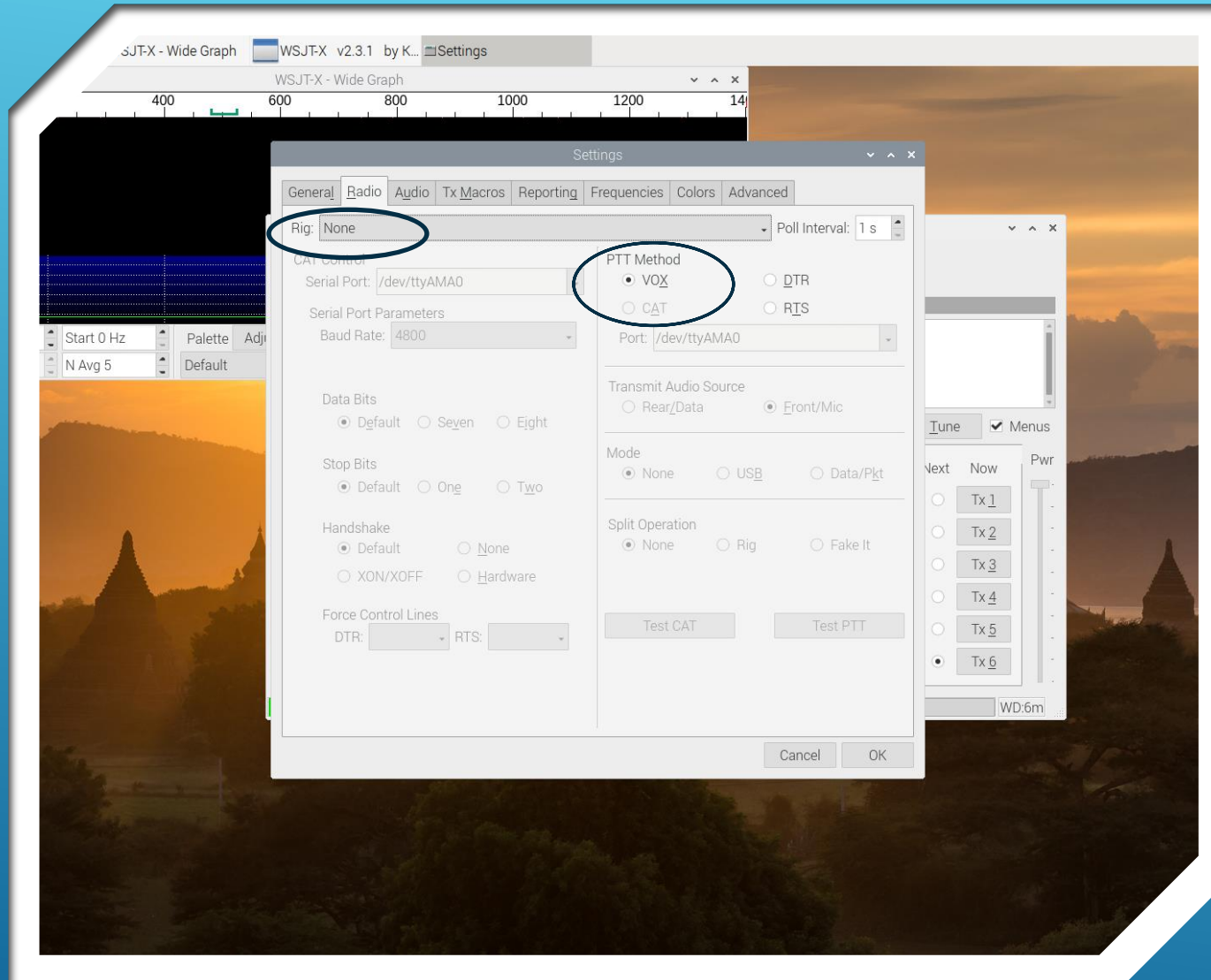
CONFIGURE WSJT-X FOR FT8

- ▶ Download and Consult the WSJT-X program manual for detailed instructions.
- ▶ Open the WSJT-X program.
- ▶ Under the File Menu go to Settings
- ▶ **Note: Click OK in each tab window to save settings for the selected tab.**
- ▶ **Under the General Tab enter your Call Sign and Grid location (EM12 in DFW area).**
- ▶ **In the "Behavior" section click the box, "Double-click on call sets Tx enable".**
- ▶ Under the Radio Tab select None for Rig and VOX for PTT method.
- ▶ Under the Audio Tab select an applicable audio source for Input and Output.
 - ▶ For straight USB connection or Signalink USB Sound Card I use sysdefault:CARD =CODEC for both.
- ▶ Under Colors Tab select colors you want to use to display various information.
- ▶ Under Advanced Tab select Two-pass Decoding



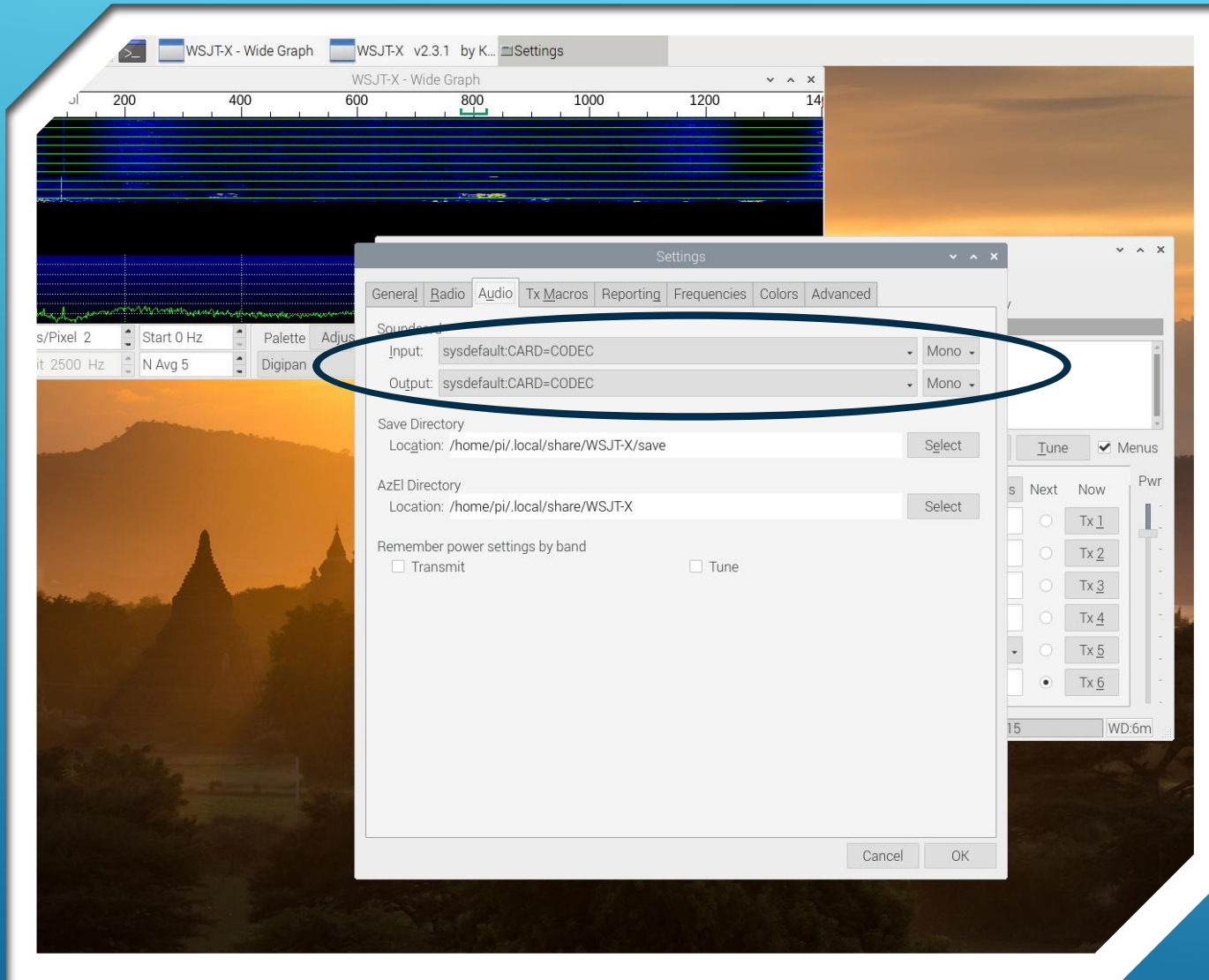
CONFIGURE WSJT-X FOR FT8

- ▶ Download and Consult the WSJT-X program manual for detailed instructions.
- ▶ Open the WSJT-X program.
- ▶ Under the File Menu go to Settings
- ▶ **Note: Click OK in each tab window to save settings for the selected tab.**
- ▶ Under the General Tab enter your Call Sign and Grid location (EM12 in DFW area).
- ▶ **Under the Radio Tab select None for Rig and VOX for PTT method.**
- ▶ Under the Audio Tab select an applicable audio source for Input and Output.
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- ▶ Under Advanced Tab select Two-pass Decoding



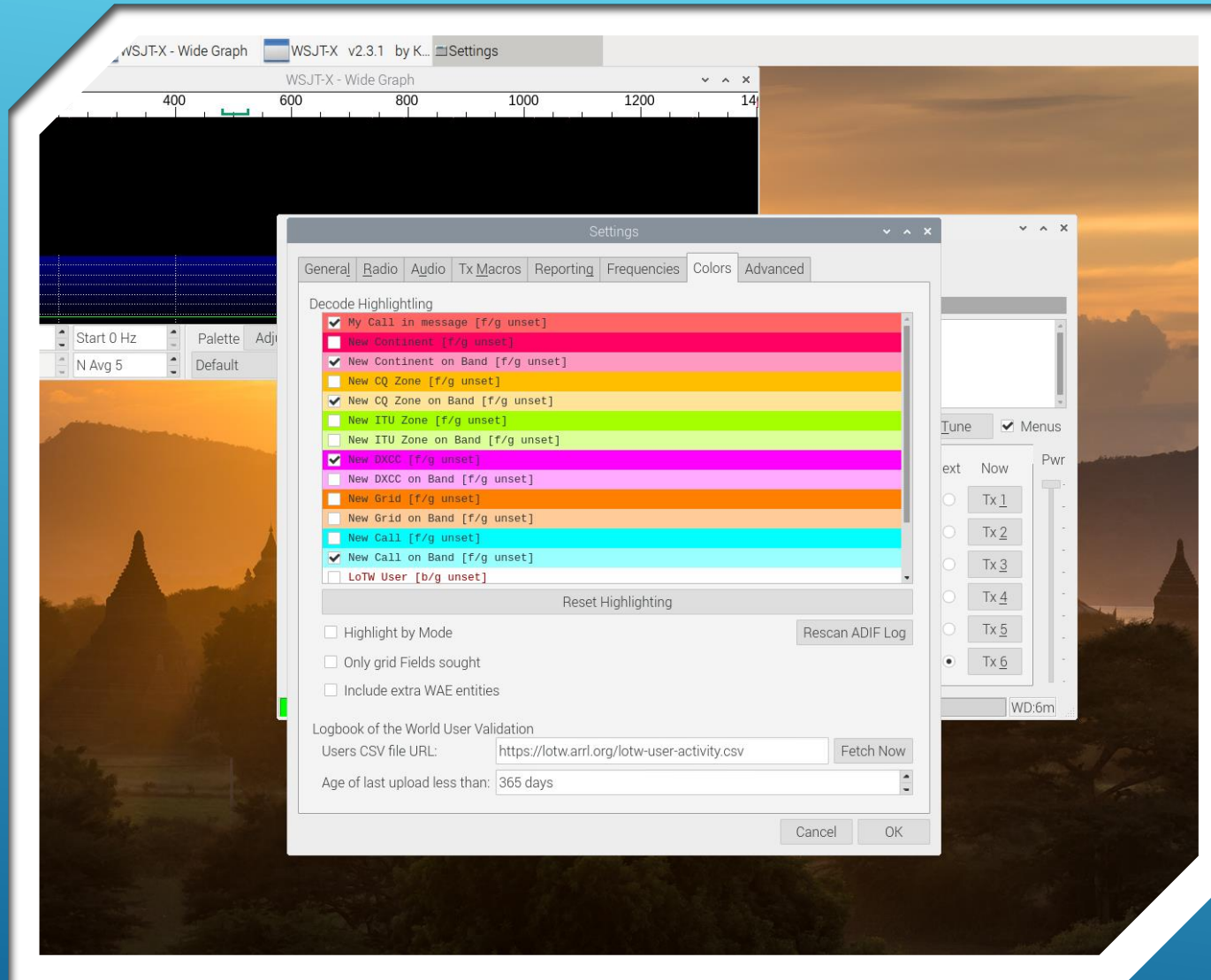
CONFIGURE WSJT-X FOR FT8

- ▶ Download and Consult the WSJT-X program manual for detailed instructions.
- ▶ Open the WSJT-X program.
- ▶ Under the File Menu go to Settings
- ▶ **Note: Click OK in each tab window to save settings for the selected tab.**
- ▶ Under the General Tab enter your Call Sign and Grid location (EM12 in DFW area).
- ▶ Under the Radio Tab select None for Rig and VOX for PTT method.
- ▶ **Under the Audio Tab select an applicable audio source for Input and Output.**
 - ▶ **For straight USB connection or Signalink USB Sound Card I use sysdefault:CARD =CODEC for both.**
- ▶ Under Colors Tab select colors you want to use to display various information.
- ▶ Under Advanced Tab select Two-pass Decoding



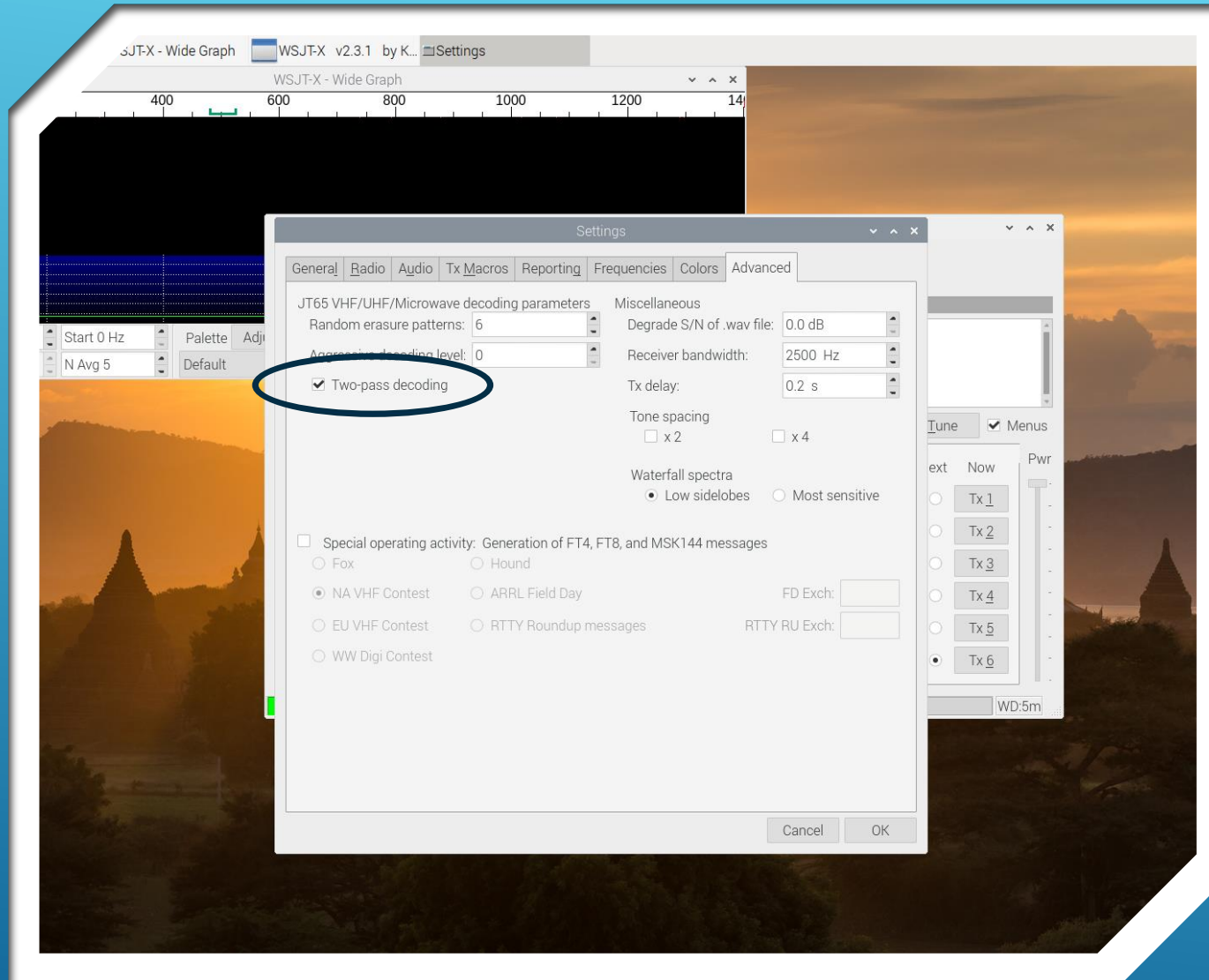
CONFIGURE WSJT-X FOR FT8

- ▶ Download and Consult the WSJT-X program manual for detailed instructions.
- ▶ Open the WSJT-X program.
- ▶ Under the File Menu go to Settings
- ▶ **Note: Click OK in each tab window to save settings for the selected tab.**
- ▶ Under the General Tab enter your Call Sign and Grid location (EM12 in DFW area).
- ▶ Under the Radio Tab select None for Rig and VOX for PTT method.
- ▶ Under the Audio Tab select an applicable audio source for Input and Output.
 - ▶ For straight USB connection or SignalLink USB Sound Card I use sysdefault:CARD =CODEC for both.
- ▶ **Under Colors Tab select colors you want to use to display various information.**
- ▶ Under Advanced Tab select Two-pass Decoding



CONFIGURE WSJT-X FOR FT8

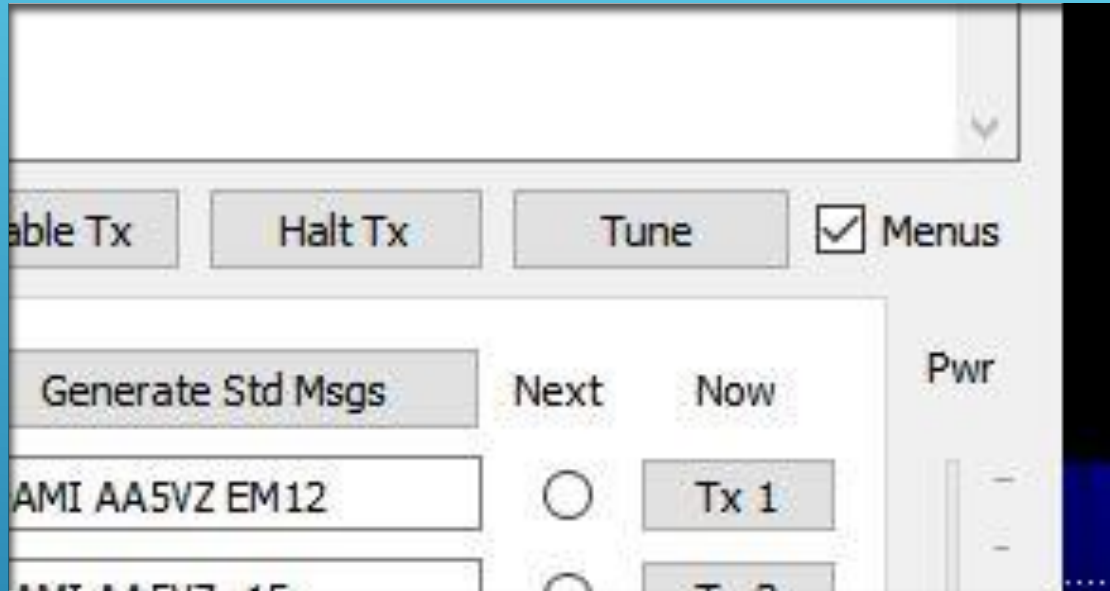
- ▶ Download and Consult the WSJT-X program manual for detailed instructions.
- ▶ Open the WSJT-X program.
- ▶ Under the File Menu go to Settings
- ▶ **Note: Click OK in each tab window to save settings for the selected tab.**
- ▶ Under the General Tab enter your Call Sign and Grid location (EM12 in DFW area).
- ▶ Under the Radio Tab select None for Rig and VOX for PTT method.
- ▶ Under the Audio Tab select an applicable audio source for Input and Output.
 - ▶ For straight USB connection or Signalink USB Sound Card I use sysdefault:CARD =CODEC for both.
- ▶ Under Colors Tab select colors you want to use to display various information.
- ▶ **Under Advanced Tab select Two-pass Decoding**



The screenshot shows the WSJT-X software interface. At the top, there are menu options: 'Configurations', 'View', 'Mode', 'Decode', 'Save', 'Tools', and 'Help'. Below the menu, there are two main windows: 'Band Activity' and 'Rx Frequency'. The 'Band Activity' window has columns for UTC, dB, DT, Freq, and Message. It shows a list of stations, with the entry '114600 -10 0.2 1219 ~ CQ NA JA1EOD PM96 A' highlighted in pink. The 'Rx Frequency' window is currently empty. Below these windows, there are several control buttons: 'CQ only', 'Log QSO', 'Stop', 'Monitor' (highlighted in green), 'Erase', 'Decode', 'Enable Tx', 'Halt Tx', 'Tune', and 'Menus'. A frequency display shows '7.074 000' with a green indicator light. To the left of the frequency display is a signal strength meter showing a red bar at approximately 80 dB. Below the frequency display, there are fields for 'DX Call' (KC3HLT) and 'DX Grid' (EM51), along with 'Az: 96' and '764 km'. A date and time display shows '2021 Apr 07 11:46:21'. On the right side, there is a 'Generate Std Msgs' table with columns for 'Next', 'Now', and 'Pwr'. The table lists several message templates, with 'CQ AA5VZ EM12' selected. At the bottom, there are status indicators for 'Receiving' (green bar) and 'FT8' (blue bar).

CONFIGURE WSJT-X FOR FT8

- ▶ Download and Consult the WSJT-X program manual for detailed instructions.
- ▶ **Connect Radio to an Antenna**
- ▶ Ensure Radio, Raspberry Pi and Interface (if used) are all powered “ON”.
- ▶ Open the WSJT-X program.
- ▶ Ensure Radio is tuned to the FT8 base frequency for the band you will be using, and that the WSJT-X band frequency and mode selection indications match. In this case we are using 40m (7.074.000 Mhz).
- ▶ If everything is connected and configured correctly, you should be able to see activity in the “Band Activity” window.
- ▶ If activity is indicated on the screen, proceed to test the transmit functions. (Next slide).



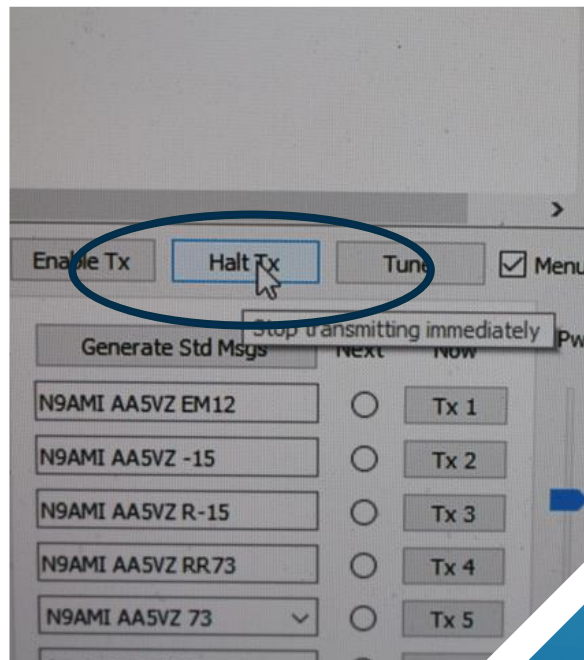
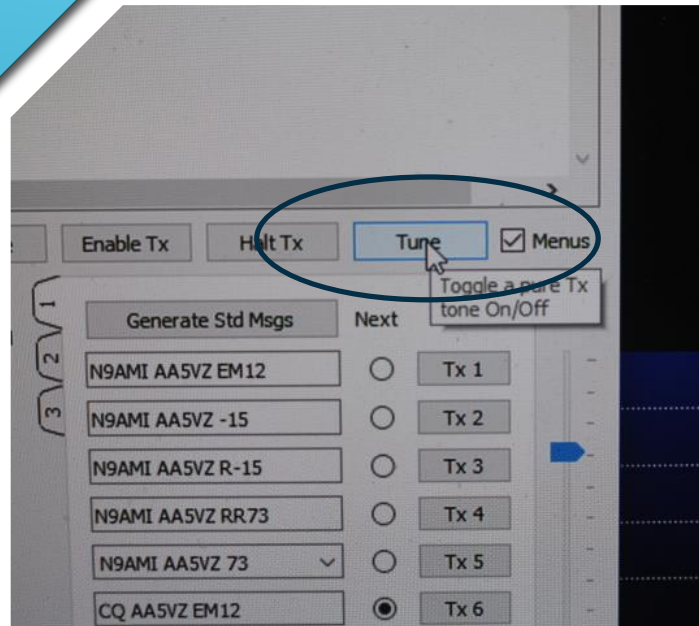
- ▶ The buttons shown will be used to test the Transmit feature of the Raspberry Pi, Interface and Radio connections.
- ▶ Proceed to next slide...

CONFIGURE WSJT-X FOR FT8

“ON-AIR” TEST

- ▶ **IMPORTANT: Use a Dummy Load when performing this test so as to NOT interfere with ongoing Amateur Radio communications.**

- ▶ Test “Transmit” mode:
- ▶ Click the “Tune” Button
- ▶ Radio should enter “TRANSMIT” mode.
- ▶ Click “Tune” Button again (or Halt Tx)
- ▶ Radio returns to “RECEIVE” mode



The screenshot shows the WSJT-X software interface. The top menu includes 'Configurations', 'View', 'Mode', 'Decode', 'Save', 'Tools', and 'Help'. The main window is divided into two panes: 'Band Activity' on the left and 'Rx Frequency' on the right. The 'Band Activity' pane contains a table of received messages:

UTC	dB	DT	Freq	Message
114600	-11	0.1	733	~ YB8RVI N9MR EN71
114600	-17	0.1	782	~ CQ WB8JUI EN81 U
114600	-15	0.2	833	~ YB8RVI K4HEB EL98
114600	-12	0.9	1087	~ JH0INE CO6SRS FL02
114600	-18	0.1	1137	~ K9ZW KW4IG 73
114600	-10	0.2	1219	~ CQ NA JA1EOD PM96 A
114600	-4	0.1	1378	~ YB8RVI N8XKA EM79
114600	-17	-0.2	1541	~ CQ K9STT EN65 U
114600	-7	0.3	1618	~ KB4LHP CM2IU +00
114600	6	0.1	2152	~ YB9FAO AD8FD RR73
114600	-18	0.1	1512	~ W1WWB K6RCS R-15
114600	-15	-0.3	2164	~ NK1I W4BTA RR73

The main control panel includes buttons for 'CQ only', 'Log QSO', 'Stop', 'Monitor', 'Erase', 'Decode', 'Enable Tx', 'Halt Tx', 'Tune', and 'Menus'. The frequency is set to 7.074 000 MHz. The mode is set to FT8. The 'Generate Std Msgs' window shows a list of messages with 'CQ AA5VZ EM12' selected for Tx 6. The status bar at the bottom indicates 'Receiving' and 'FT8'.

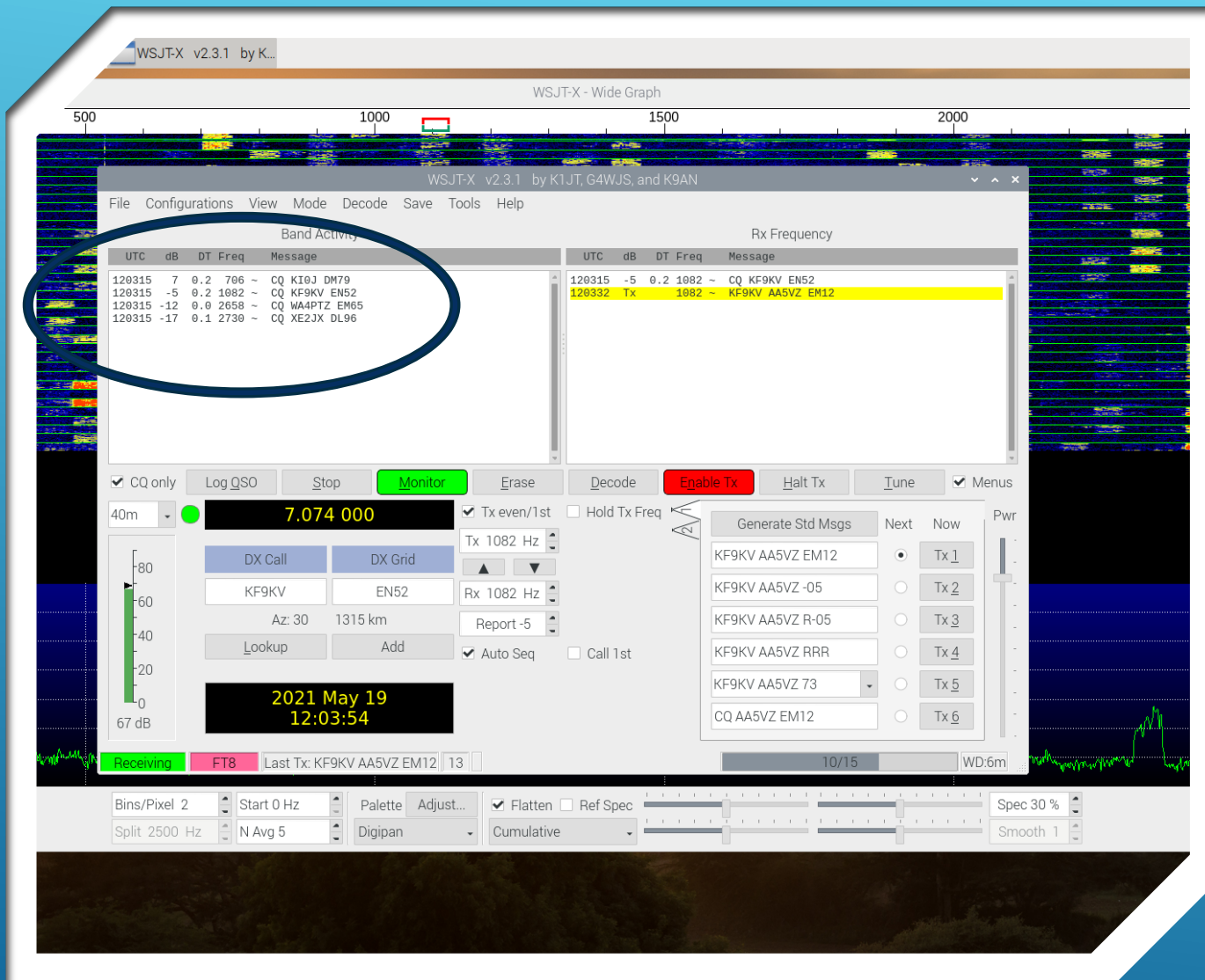
CONFIGURE WSJT-X FOR FT8

- ▶ Download and Consult the WSJT-X program manual for detailed instructions.
- ▶ **Connect Radio to an Antenna**
- ▶ **Ensure Radio, Raspberry Pi and Interface (if used) are all powered "ON".**
- ▶ **Open the WSJT-X program.**
- ▶ **Ensure Radio is tuned to the FT8 base frequency for the band you will be using, and that the WSJT-X band frequency and mode selection indications match. In this case we are using 40m (7.074.000 Mhz).**
- ▶ **If everything is connected and configured correctly, you should be able to see activity in the "Band Activity" window.**



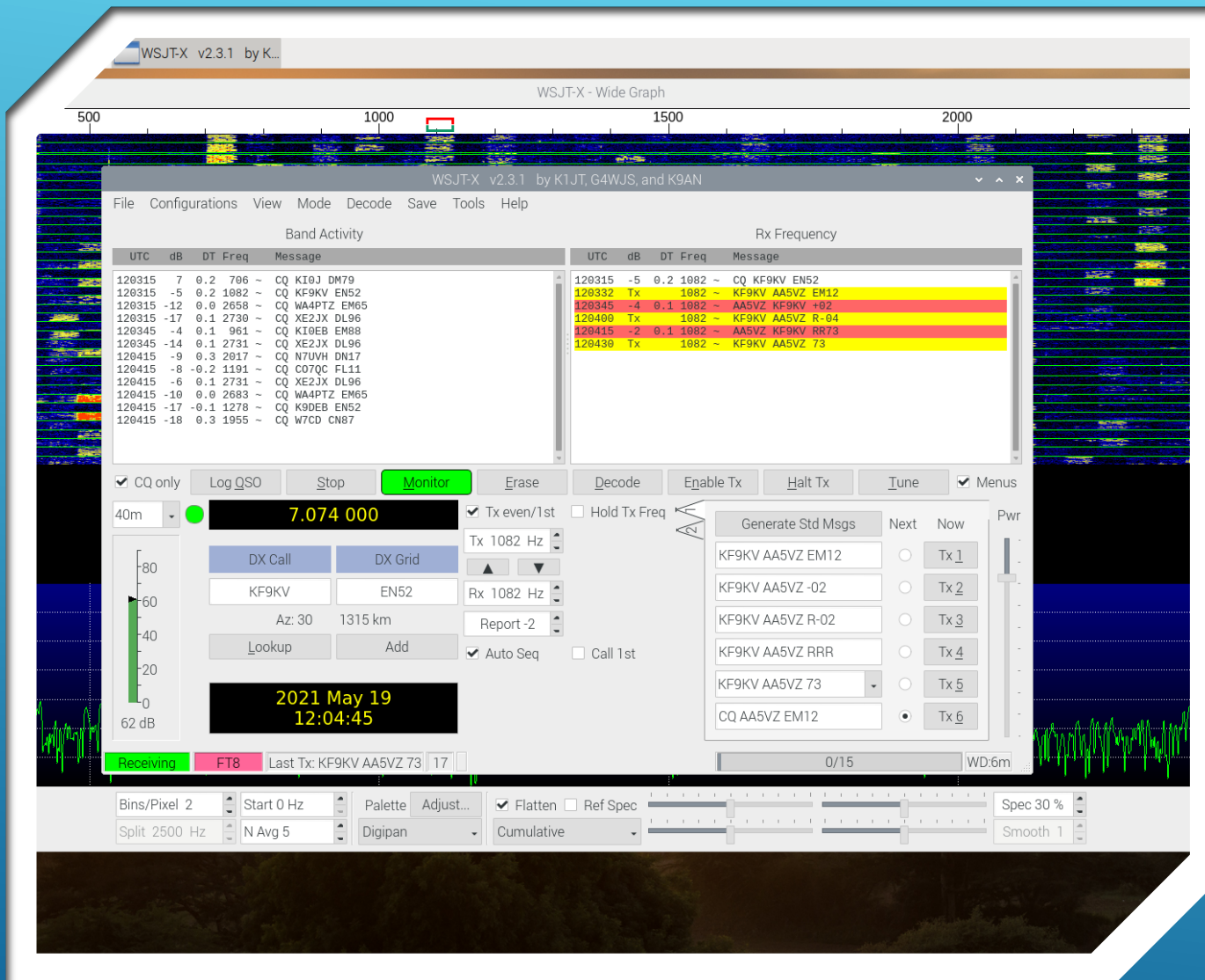
- ▶ Consult the WSJT-X program manual for detailed instructions.
- ▶ On the WSJT-X Dashboard, “check” the box “CQ only”.

GET ON THE AIR



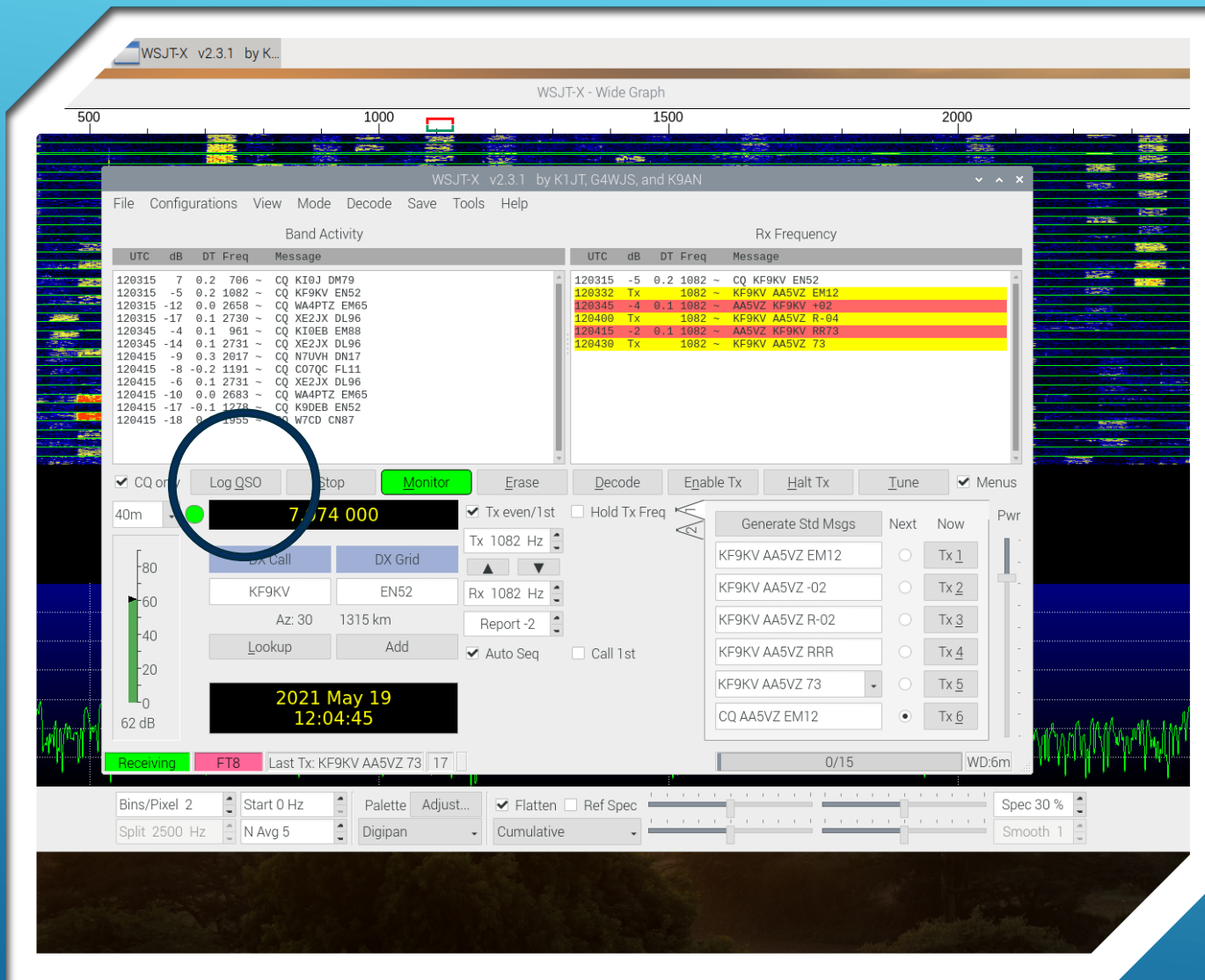
GET ON THE AIR...

- ▶ Only stations calling “CQ” will be displayed in the “Band Activity” window.
- ▶ “Double-click” on the callsign you wish to call.
- ▶ The “Yellow” line indicates the message you are transmitting to the station you selected.



GET ON THE AIR... HAVE FUN!

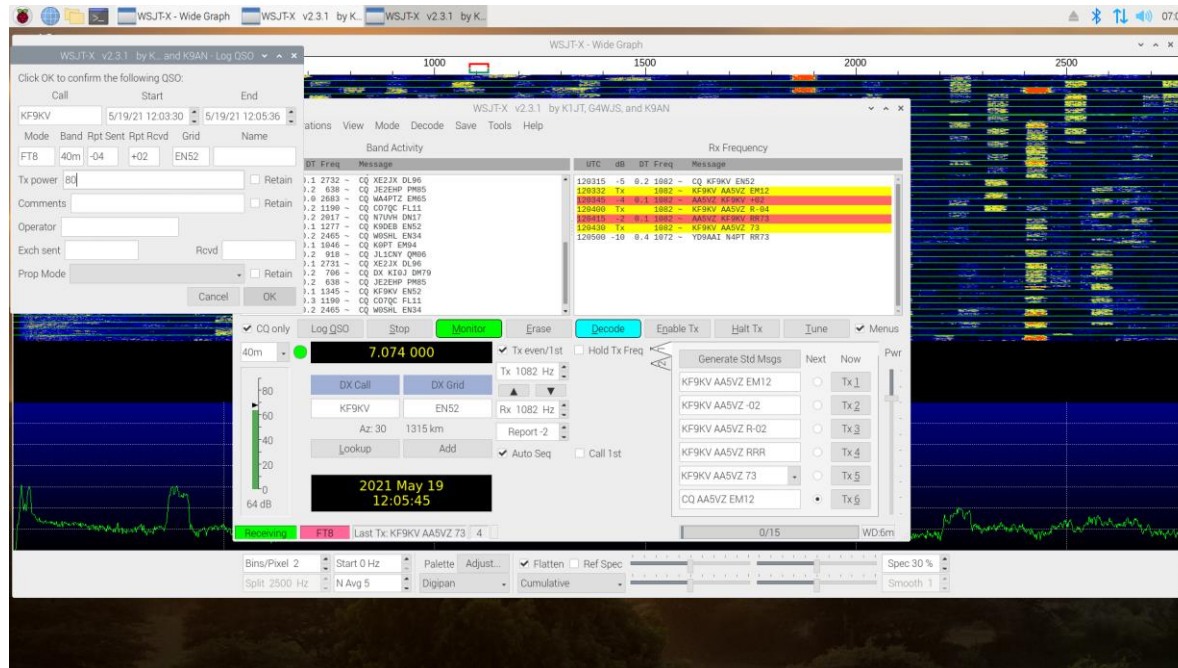
- ▶ Consult the WSJT-X program manual for detailed instructions.
- ▶ The “Yellow” line indicates the message you are transmitting to the station you selected.
- ▶ The subsequent “Red” line indicates station called heard you and is calling you back.
- ▶ The remaining messages cycle automatically until the QSO is completed (when both stations have sent “73” in their message).
- ▶ At this point you can log the QSO and work another station.
- ▶ **YOU DID IT! CONGRATULATIONS!**



LOGGING THE QSO

- ▶ Consult the WSJT-X program manual for detailed instructions.
- ▶ Click on the "LOG QSO" Button

LOGGING THE QSO



▶ Consult the WSJT-X program manual for detailed instructions.

▶ Basic Information about the QSO is already pre-populated on the form.

▶ Enter additional information you want to record such as station power or any other comments

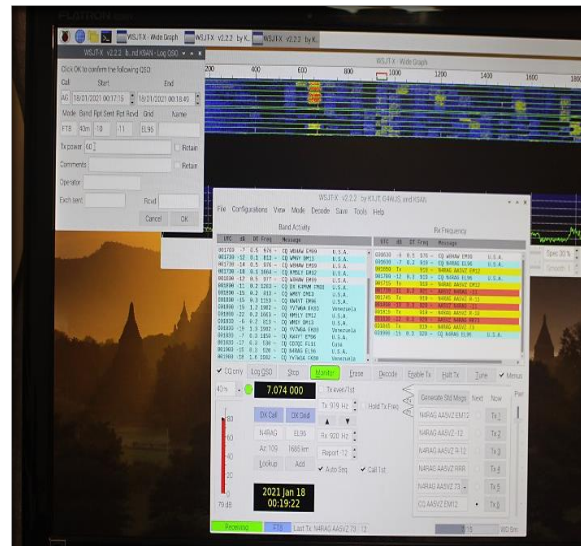
▶ Click the “OK” Button

▶ That’s all there is to it.

▶ Congratulations!

GETTING STARTED... MOVING FORWARD

- ▶ Assemble a Raspberry Pi-4 Workstation
- ▶ Load the base Operating System (O/S)
- ▶ Install and Configure Ham Radio Apps
- ▶ Interface the Pi with your Station
- ▶ Get on the Air!



1. Link to configure WSJT-X for operation with Icom IC-7300

<https://www.k0pir.us/icom-7300-wsjt-x-ft8-easy-way/>

2. WSJT-X Home Page

3. <https://www.tigertronics.com/slusbmain.htm>

4. www.google.com

5. www.youtube.com

REFERENCES

QUESTIONS OR TESTIMONIALS?



GETTING STARTED USING RASPBERRY PI IN THE SHACK (PART 2)

Jack Weaver – AA5VZ