Autonomous Vehicles Research Studio Safety Instructions

About normal safety considerations and precautions, please check Autonomous Vehicles Research Studio Setup Guide, which includes the following topics.

Table 1 Safety related topics covered by Research Studio Setup Guide

#	Topic	Description	At page
1	Operator Warnings	General warnings when operating the devices	1
2	Safety Considerations and Precautions	Floor mats recommendation	6
		Netting guidelines	6
		General safety guidelines	8
3	LiPo Batteries Safety	Batteries safety guidelines	17

Here are the steps mentioned in the Autonomous Vehicles Research Studio Setup Guide will ensure that your Autonomous Vehicles Research Studio is fully set up and functional. Ensure that each step is followed carefully. You can track your progress using the checklist here.

Table 2 AVRS setup full checklist

Step	Section	Checkpoint Task	Completed
1	Studio Safety Setup	Workspace Picture	
2	Optitrack Cameras Mounted	Localization System Picture	
3	Wiring and Connectivity	Setup Picture	
4	Software Licensing and Testing	Sine Scope Demo	
5	Joystick Setup	Joystick Visualization Demo	
6	Camera Orientation	Reference View Screenshot	
7	Camera Calibration	Captured Volume Screenshot	
8	QDrone 2 Communication	Basic TCP/IP Demo	
9	Optitrack with Simulink/Quarc	Optitrack Visualization Demo	
10	QDrone 2 Functionality Test	QDrone 2 IO Check	
11	QDrone 2 Flight	QDrone 2 Hover Test	

Please find Autonomous Vehicles Research Studio Setup Guide to get more details on how to complete these steps.

How to stop the QDrone 2 if there is an accident?

1. The controller Simulink model is stopped but the propellers on QDrone 2 keep spinning.

This means the Simulink model (.slx file) that controls the QDrone 2 is stopped, but the propellers on QDrone 2 keep spinning.

In recent releases of the AVRS Resources, this should have been solved and would not happen, you can find the updated resources here.

The Simulink model typically would stop in 3 different ways.

1. Automatically stopped by the code.
2. User clicked "Stop" button under the running Simulink model's "Hardware" Tab then the Simulink model stops and the button changes back to "Monitor & Tune".
3. User uses the Emergency Stop Button on the Joystick forcing the running Simulink model to stop. (This way is only valid when running the Simulink model that controls QDrone 2 with Joystick)

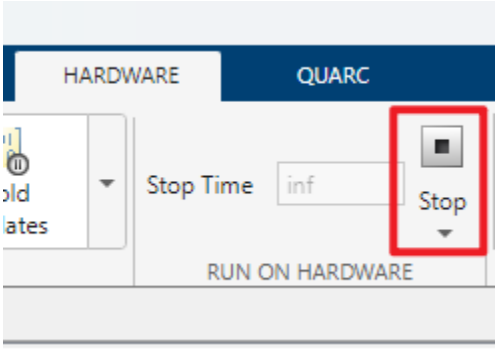


Figure 1 "stop" button of running Simulink model

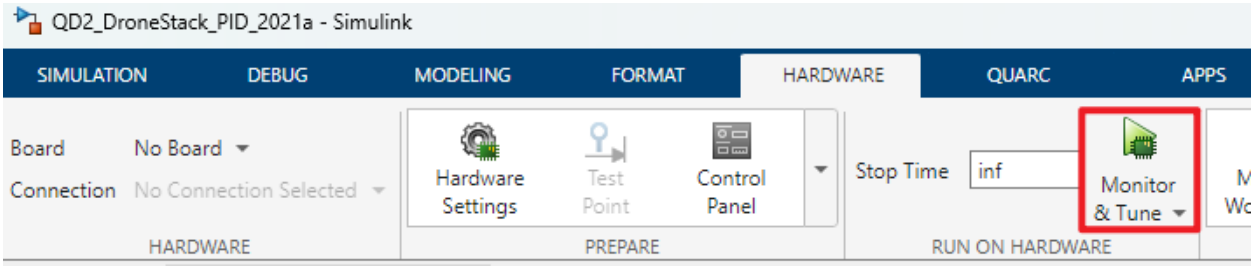


Figure 2 stopped Simulink model's menu bar

Solutions:

IMPORTANT: If QDrone2 is flying all over around unexpectedly inside the netting, it is not safe to go inside the netting or try catching it with the netting. Please stay behind the netting and wait for the battery to run out - the maximum wait time should be less than 10 minutes anyways (since that is QDrone2's max flight time)

If QDrone2 is on the ground and stay still, you can try the follow ways.

Try to toggle the “ESCs Enable Switch” to see if that would force the ESCs to stop the motors from spinning when you can approach the QDrone 2 safely and must wear safety eyeglasses and protective gloves before doing all these.

Figure 3 protective gloves and safety eyeglasses

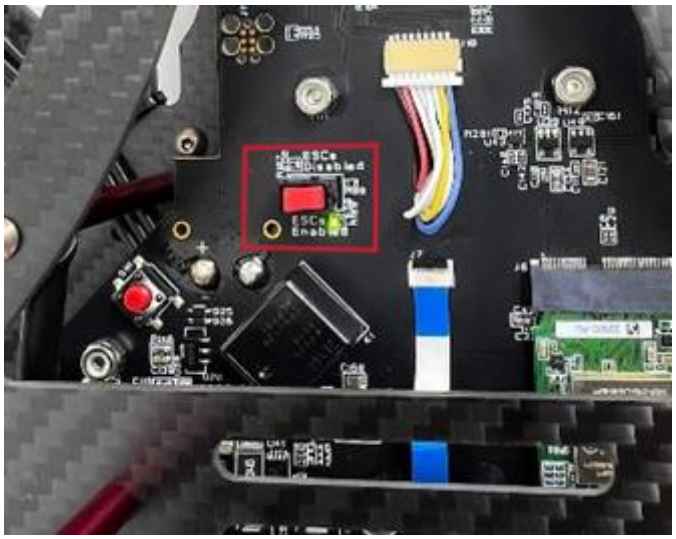


Figure 4 ESCs Enable Switch on QDrone2
LED Green – ESCs enabled (Motors allowed to spin)
LED Red – ESCs disabled (Motors not allowed to spin)

If even the “ESCs Enable Switch” is not working, you could try turning off the QDrone 2 with the power button or just disconnect the battery – make sure you can approach the QDrone 2 safely.

If press the power button once could not turn off the QDrone 2, keep pressing the power button for about 5 seconds then release, this would force the QDrone 2 to power off.

Or just disconnect the battery if it is safe, you should wear safety eyeglasses and protective gloves before doing all these.

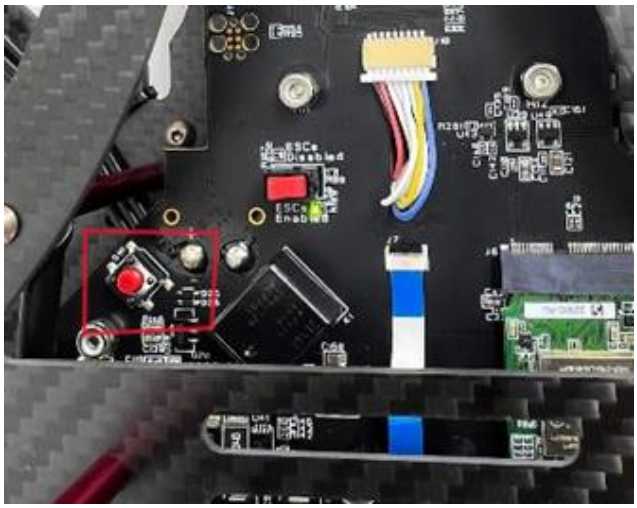


Figure 5 power button on QDrone2

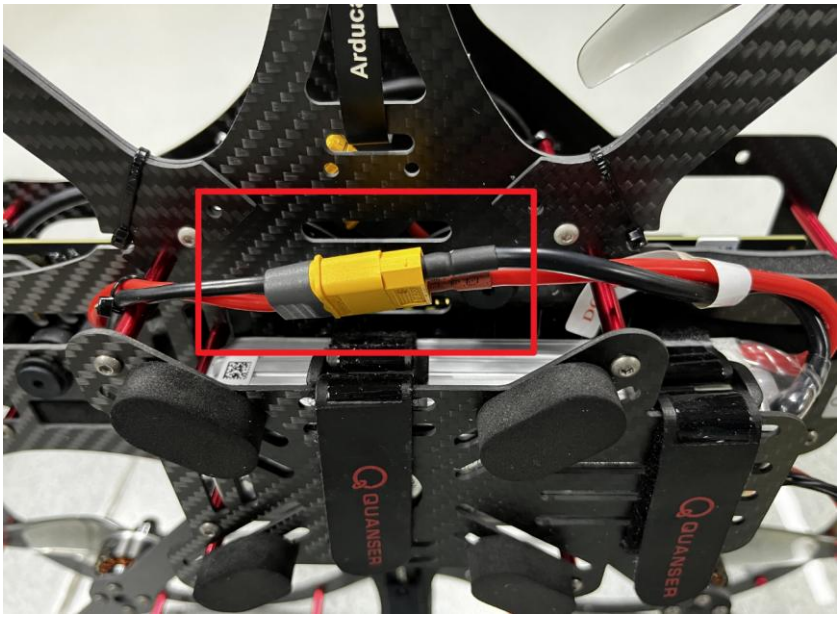


Figure 6 battery connector on QDrone2

2. The QDrone 2 went out of control while Simulink controller model[1] is still running.

Try keep holding the Joystick's Emergency Stop Button, it should stop the propellers and the running model, see below image indicates the Emergency Stop Button

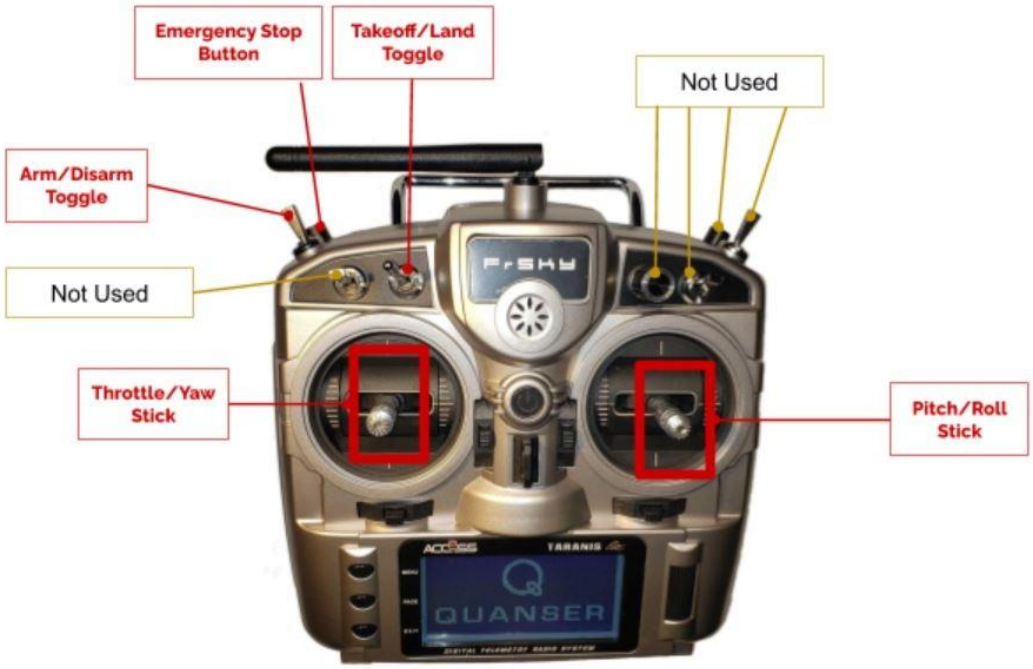


Figure 7 Joystick function descriptions

If this couldn't stop the running model, and the model keep running, try use QUARC console or monitor to stop the running model, here is how:

Note: whether using QUARC console or monitor, better open the console/monitor before running the model in case Simulink freezes (not responding) when QDrone 2 is out of control.

A. Using QUARC console:

1. Under Simulink's QUARC menu tab, use the Console button to open a relevant console for current Simulink model's target.

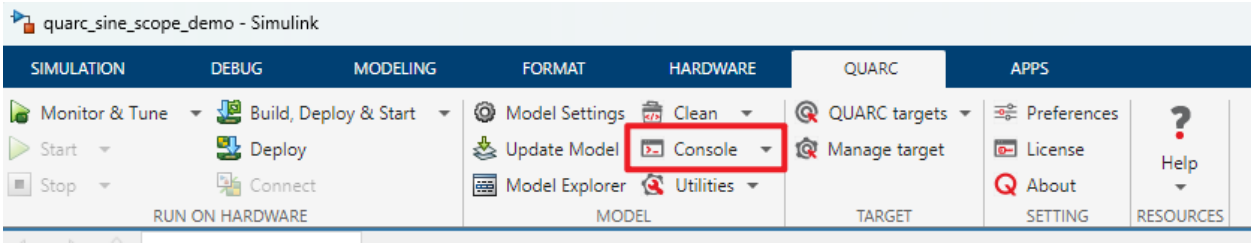


Figure 8 Console button on Simulink's QUARC menu tab

[1] All the "running model", "controller model", "model" in this document refer to the compiled Simulink model that controls QDrone 2.

2. Make sure the console window is selected (in focus).

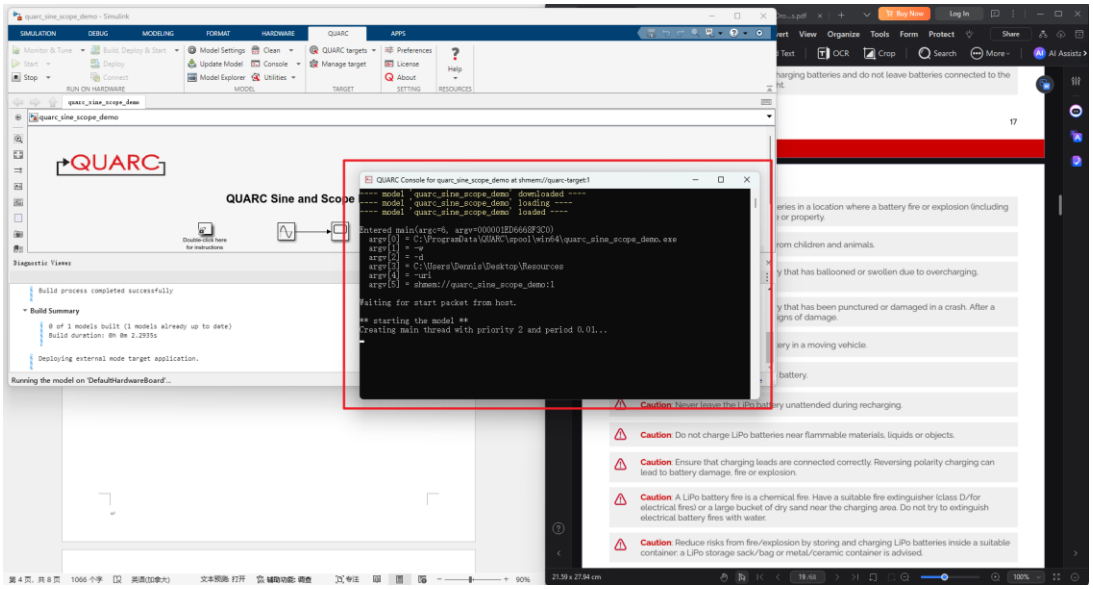


Figure 9 console window should be in focus and on top of other windows

3. Press the “Break” key on the keyboard, this would send a “stop all” message to the QUARC run-time manager running on the QDrone 2, it should stop all the running models on the QDrone 2. below image indicates where the “Break” key is on the keyboard.

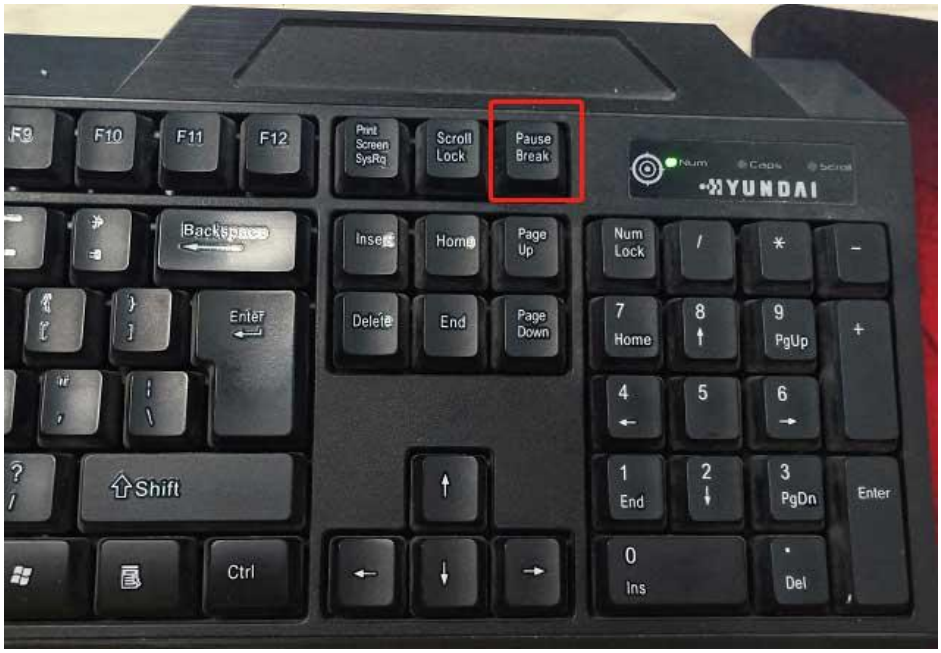


Figure 10 Pause/Break key on a standard keyboard

4. After pressing the “Break” key, QUARC console would display “terminated” message that tells you the model stopped.

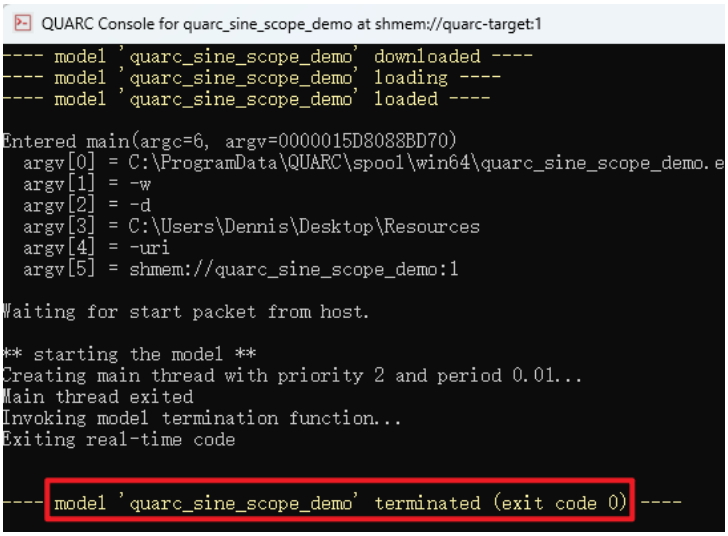


Figure 11 QUARC Console shows model terminated

B. Using QUARC Target Monitor:

1. Under Simulink's QUARC tab, use the Manage target button to open a QUARC target monitor for current model's target, you will see the running model under the "Models currently loaded on the target" section.

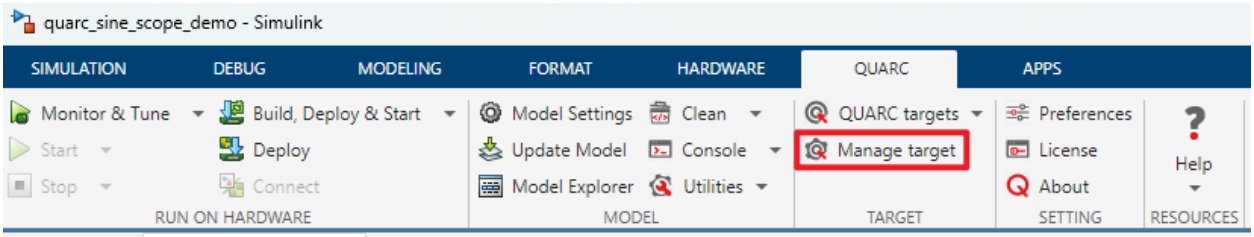


Figure 12 "Manage target" button on Simulink's QUARC menu tab

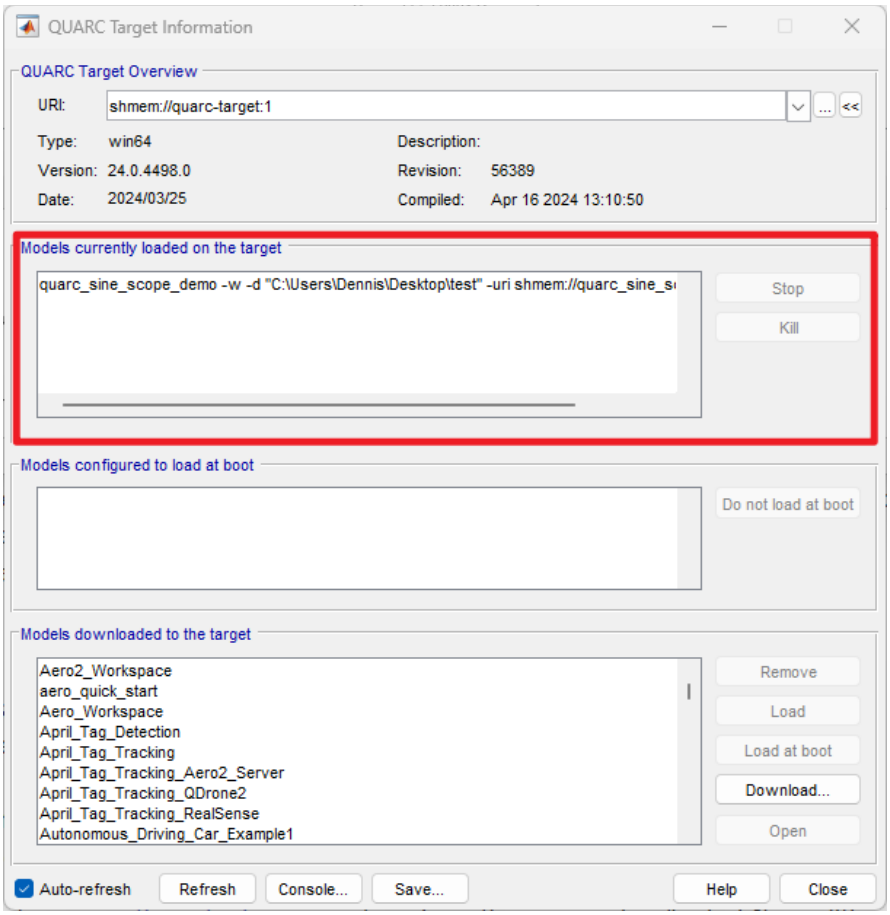


Figure 13 QUARC Target Monitor

2. Select the model currently loaded and click Stop or Kill button on the right to stop or kill the model.

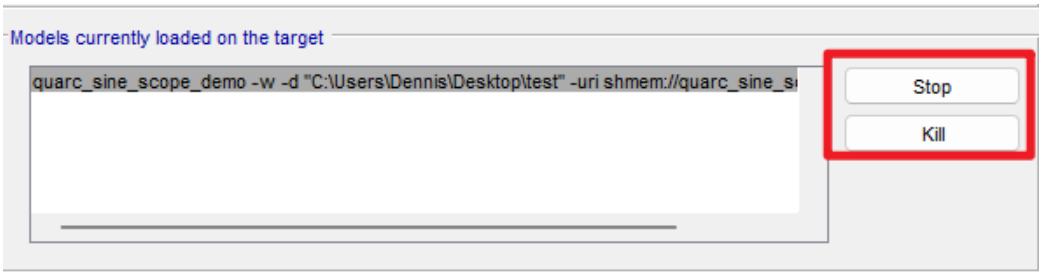


Figure 14 Select the model and click Stop or Kill

If you did not open the QUARC console or monitor before running the model, and Simulink window already freezed (not responding) when QDrone 2 is out of control, here is another way you can try to open the QUARC console and monitor.

1. Under the system tray, right click on the QUARC Monitor icon  .

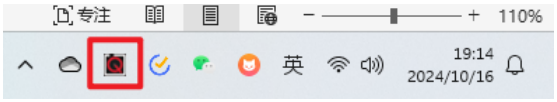
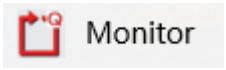


Figure 15 QUARC Monitor icon under the system tray

2. If you can not find the QUARC Monitor icon, it might be hidden, if you can not find it anyway, you can open the Start Menu and search “Monitor” then click 

and a new QUARC Monitor icon should popup under system tray)

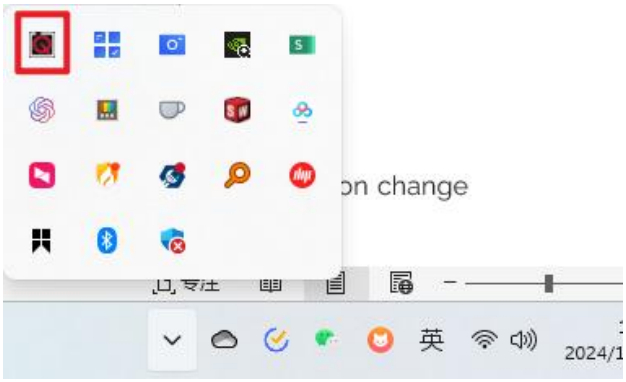


Figure 16 Example of hidden QUARC Monitor icon

Figure 17 QUARC Monitor in Start Menu

3. Under the Target menu, select “Remote…”.

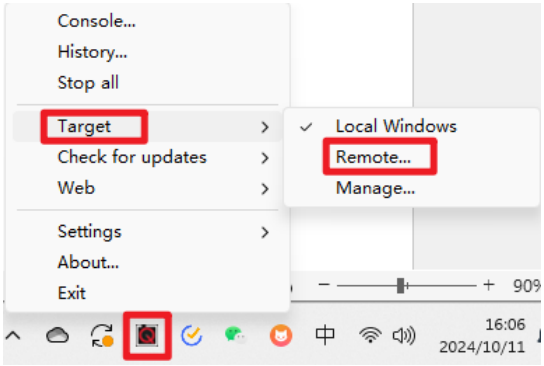


Figure 18 remote target setting

4. In the popup window, change the Target URI into QDrone2's IP address and click OK. (for example, if QDrone2's IP address is 192.168.2.12, then the Target URI should be "tcpip://192.168.2.12:17000")

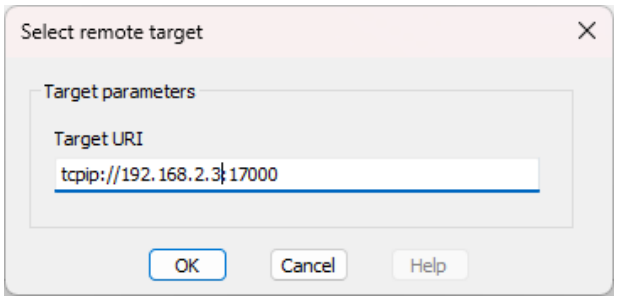


Figure 19 remote target URI setting

5. The QUARC Monitor will try to connect to the remote target, wait until the icon change from  to  , this indicates the Monitor is connected.

6. Then you can select "Console…" in the right click menu to open a QUARC console for QDrone 2 or select "Manage…" under Target menu to open a QUARC Monitor

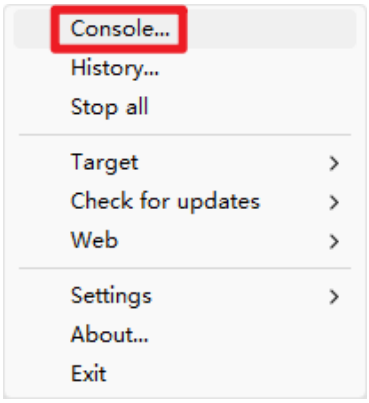


Figure 20 open QUARC Console in the right click menu

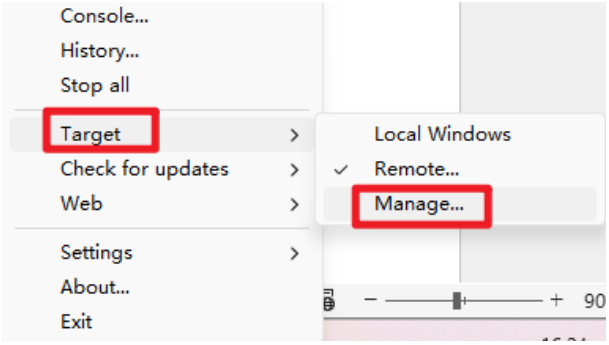


Figure 21 open QUARC Target Monitor in the right click menu

7. Follow these instructions to stop the model.

How to improve Wi-Fi connection stability?

The QDrone 1/2 does not have a preset IPV4. For a successful connection, the DHCP server option on the router must be enabled. For the Netgear Nighthawk router provided with the AVRS system, the DHCP server can be found by going to Advanced/Setup/LAN Setup.

To ensure compatibility with the Self-Driving Car Research studio, the 5GHz band for the Netgear Nighthawk router has been configured to channel 44.

If you do notice intermittent issues with communication to any of the vehicles, it is recommended that you use a Wi-Fi spectrum analyzer and check if there are networks which are broadcasting on the same channel but at a higher signal strength.

Microsoft has a free Wi-Fi analyzer:

https://www.microsoft.com/en-us/p/wifi-analyzer/9nblggh33n0n?activetab=pivot:overviewtab#

You may use the link provided for Microsoft's WiFi utility. You can change the Netgear Nighthawk's channel number by logging into the router and checking the channel number under the 5GHz wireless band.

Note: Above are the instructions from Autonomous Vehicles Research Studio Setup Guide, here is the steps to analyze your current Wi-Fi environment and choose a more stable channel for QDrone.

1. Install the Wi-Fi analyzer on your laptop or PC with a wireless Ethernet card using the provided link, open Wi-Fi analyzer from the Start Menu.

Figure 22 WiFi Analyzer in Start Menu

2. Connect your laptop or PC to QDrone2's Wi-Fi network, ensuring both the 5GHz and 2.4GHz bands are checked for optimal connectivity

   the 5GHz and 2.4GHz bands on the router have been configured as follows:

   5GHz: SSID: Quanser_UVS-5G Password: UVS_wifi

   2.4GHz: SSID: Quanser_UVS Password: UVS_wifi

3. In the Connection Panel（連接面板), you can see the Wi-Fi information your laptop currently connects to, which includes frequency band and channels.

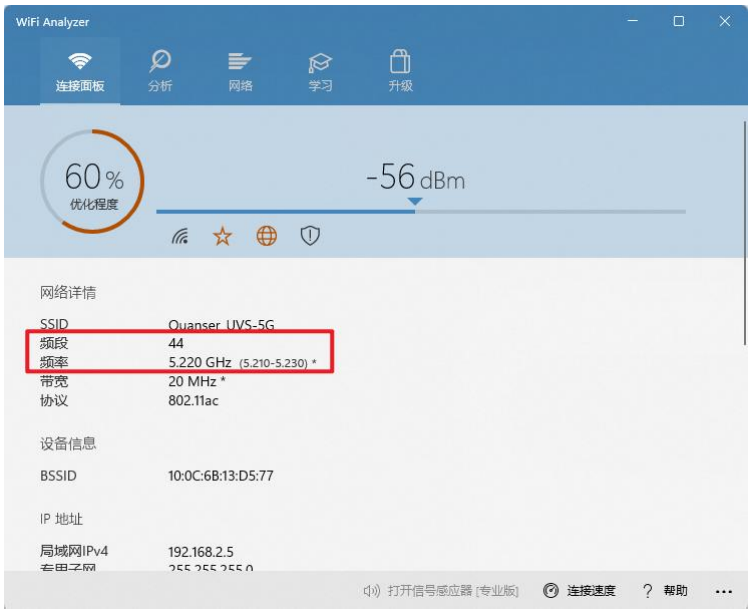


Figure 23 WiFi Analyzer Connection Panel

4. Click Analyze (分析) on the menu, it would show you the current Wi-Fi spectrum of all available Wi-Fis from your location.

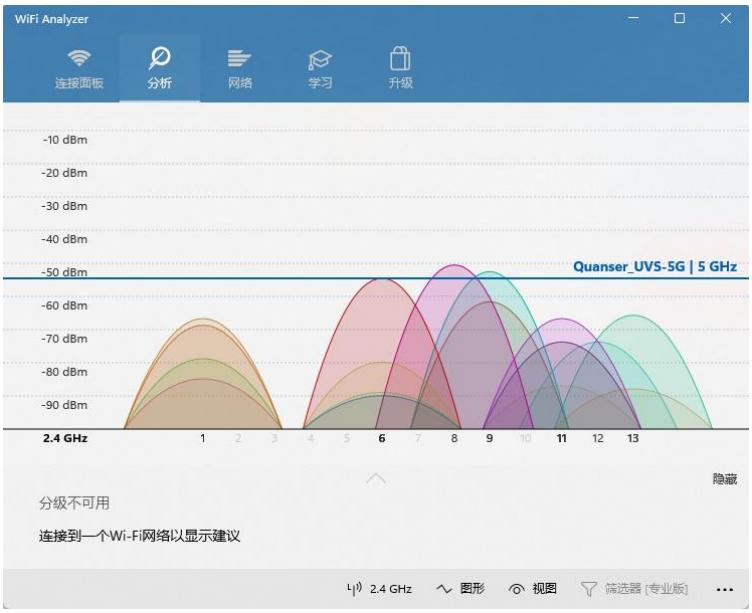


Figure 24 WiFi Analyzer Analyze Panel

5. Choose the band under the menu below to match current Wi-Fi band. That say, if you connected to Quanser_UVS then choose 2.4GHz, if you connected to Quanser_UVS-5G then choose 5GHz.

Figure 25 choose the corresponding band

6. Check the spectrum for other Wi-Fi signals on the same or similar channels. Choose a channel with the least overlap, as indicated by star ratings in the Wi-Fi analyzer's suggestions.

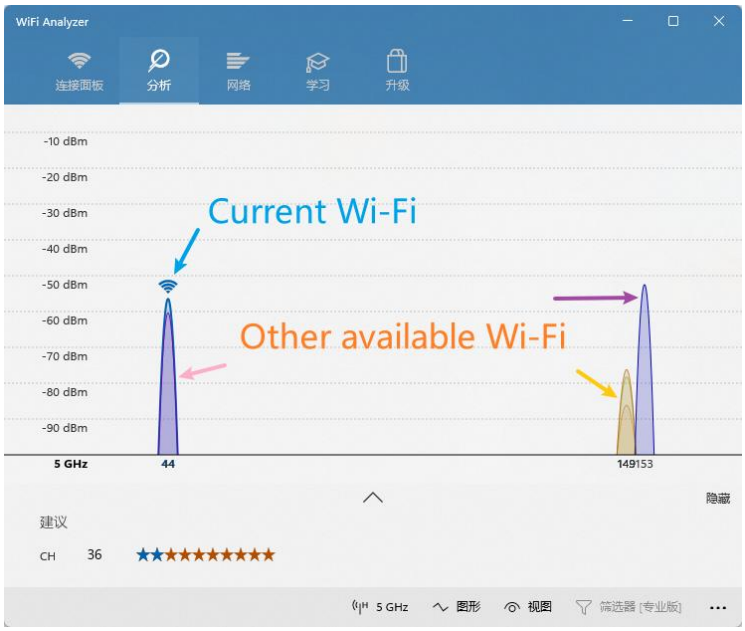


Figure 26 WiFi Analyzer spectrum of available wireless networks

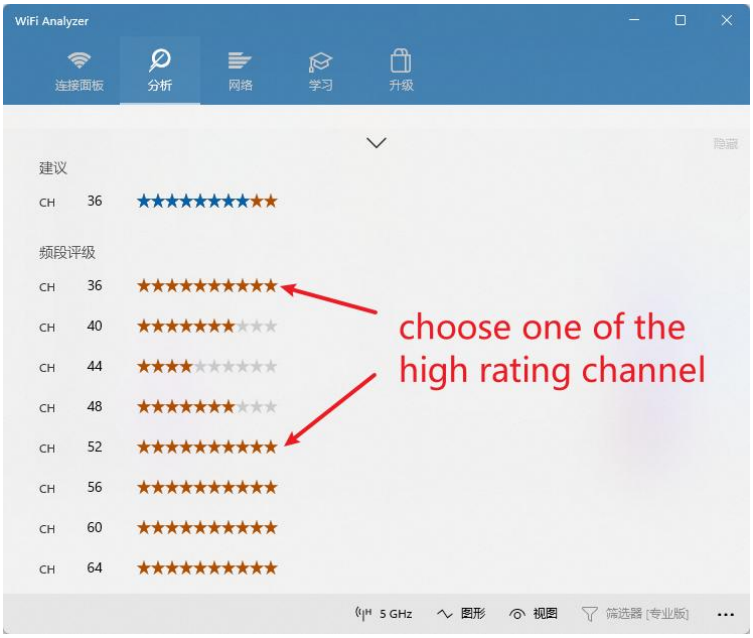


Figure 27 WiFi Analyzer suggested channels

7. Remember the channel. Open a web browser and input the link 192.168.2.1 to login to the router using the credentials here.

   Username: admin Password: Quanser_123

Figure 28 login to the router

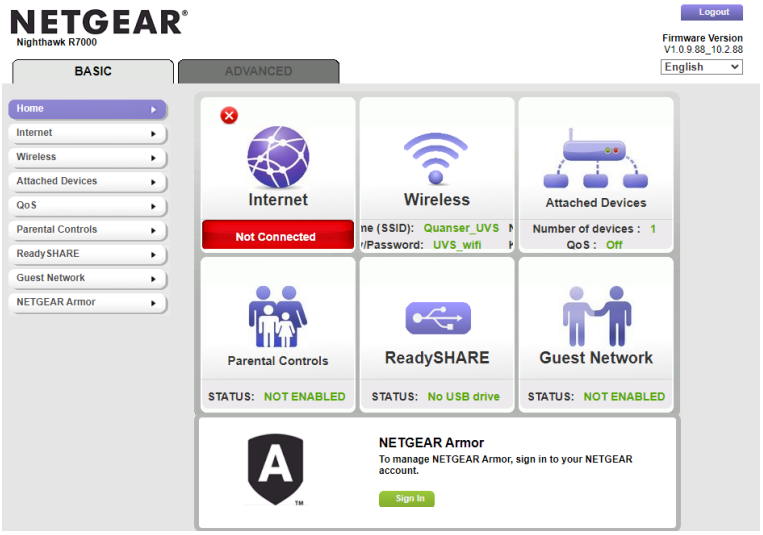


Figure 29 router control panel

8. Click “ADVANCED” in the top menu, then expand “Setup” on the left and select “Wireless Setup”. In the wireless settings, change the channel to match the optimal one identified using Wi-Fi analyzer, make sure you update both the 2.4GHz and 5GHz bands accordingly.

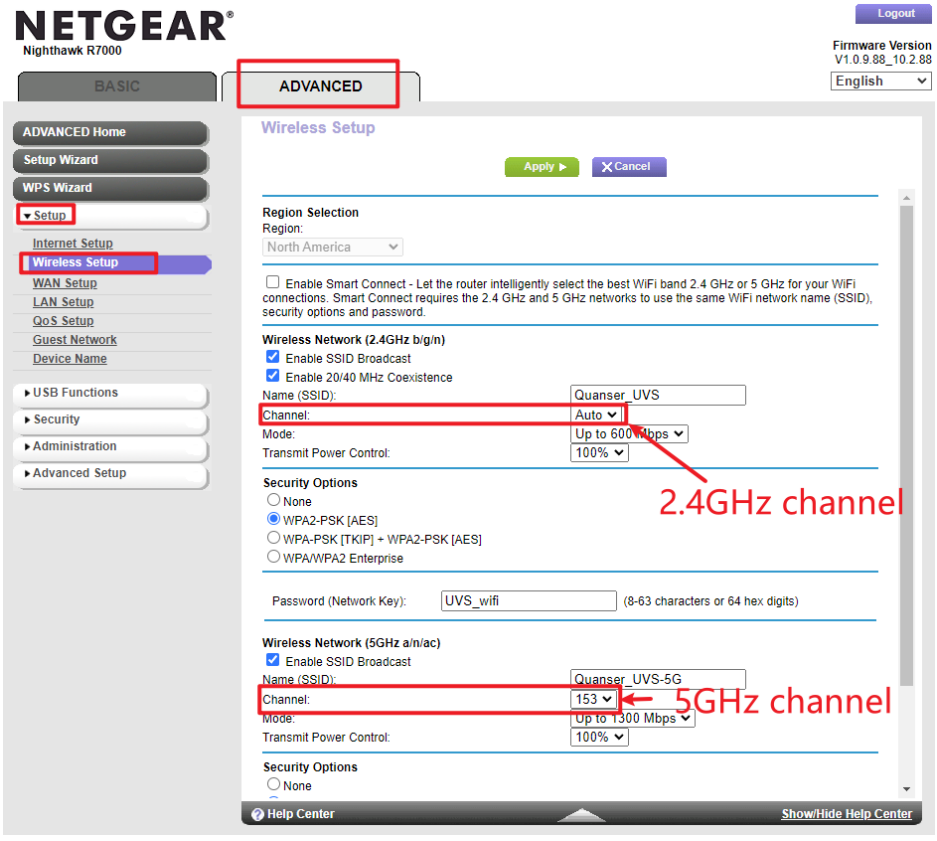


Figure 30 change channel setting for both 2.4GHz and 5GHz

9. Click “Apply” to save the settings, the router will automatically reboot.