WAVELENS

Full Spectrum kit: instructions

Your kit arrives programmed, set up for your area and tested as one rig. Set it up on a table at home first, which takes about twenty minutes and proves every part works. Then, if it is going in a vehicle, follow the installation steps in order. No soldering and no software to install on the kit.

Applies to Full Spectrum ($499). Going in a vehicle? Read the power section before you buy anything.

In this booklet

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Online, with more detail: this guide, kept up to date, with links to every section of the vehicle guide.
wavelensapp.us/kit.html

In the box

Part	What it does
Scanner: a Raspberry Pi in a vented case with a fan, memory card installed	Runs the kit and talks to your phone over Bluetooth. Nothing to log into.
RTL-SDR A with a short 433 MHz whip on a small magnetic base	Sensors: tyre-pressure sensors, key fobs, remotes and meters.
RTL-SDR B with a wideband whip on a roof magnetic mount and a 3 m lead	The radio scanner: VHF, UHF, 700 and 800 MHz.
Two USB extension cables, 6 inches or longer, and the adapters each antenna needs	One per RTL-SDR, to keep them apart and off the Pi's own ports.
Spotter in its black enclosure, with its low-profile antenna and a short USB cable	Wi-Fi and Bluetooth: cameras, trackers, drones and the rest of what the app names.

The two RTL-SDRs are labelled **A** and **B**. Each has its own antenna; do not swap them.

What you need

- **A USB-C power supply that delivers 5 V at 5 A.** It is not in the box, because the right one depends on where you use the kit. See the next section before you buy or reuse one.
- **A phone or tablet with the Wavelens app**: Android 8 or later, or an iPhone or iPad on iOS 17 or later. Get it at **wavelensapp.us**.

- **Wi-Fi at home**, for the first setup and for updates. The kit does not need Wi-Fi or mobile data to scan.
- **For a vehicle:** a 12 V to 5 V converter rated 5 A, a powered USB hub, an add-a-fuse tap with a 5 A fuse, and a little wire. Sizes and prices are in step 2 below.

Power: 5 V at 5 A

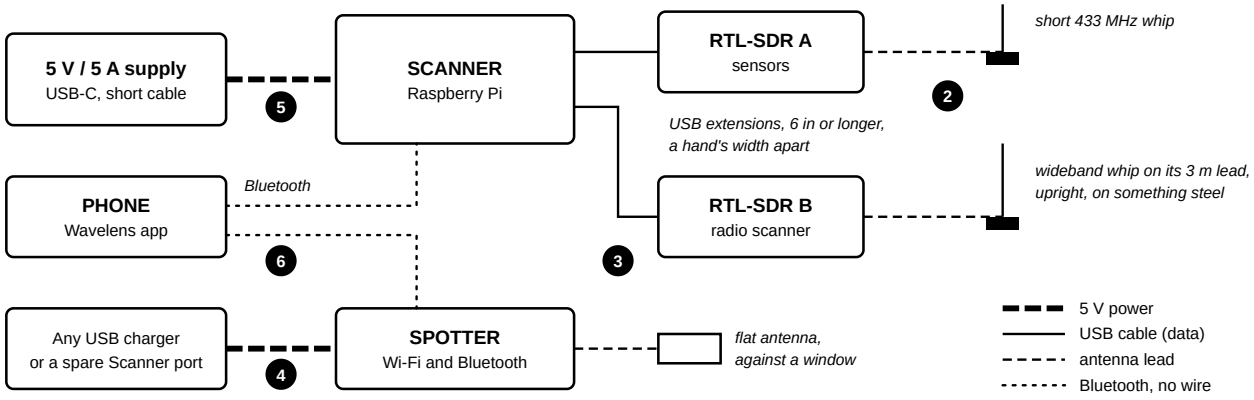
> **The one thing that decides whether the kit works**
>
> The Scanner and its radios need a steady **5 volts at 5 amps** (25 watts). **If you install the kit in a vehicle, it must be powered by a good 5 V / 5 A supply.** A weak supply does not fail cleanly: the radios drop out one at a time, the Scanner restarts over bumps and at traffic lights, and it looks like a faulty radio when it is the power.

Where	Use	Do not use
At home	A USB-C supply marked **5 V 5 A** (often sold as 27 W for Raspberry Pi), with its own attached cable or a short, thick one.	A phone charger, a laptop's USB port, or a supply marked 5 V 3 A or less.
In a vehicle	A **12 V to 5 V converter rated 5 A continuous** with a USB-C plug, wired to an ignition-switched fuse (steps 2 to 6 below).	A lighter-socket plug marked 2.4 A or 3 A. They sag under load and reset the Scanner.

A note on fast chargers: a USB-C car charger's big wattage number is for 9 to 20 volts, which the Scanner does not use. Read the small print for the **5 V** line. If it says 5 V 3 A, it is a 15 watt supply as far as this kit is concerned, whatever is printed on the front.

Part 1: set up at home

Do this on a table before anything goes in a vehicle. If a part was damaged in the post, you find out here, not after an afternoon of routing cables.



Home setup. The numbers are the steps below.

1 Check the parts

Lay everything out against the list above. The memory card is already inside the Scanner; leave it there.

2 Fit the antennas

Screw the short 433 MHz whip's lead onto RTL-SDR **A** and the roof whip's 3 m lead onto RTL-SDR **B**. Finger-tight is enough; do not use pliers. Stand each antenna upright, on something steel if you have it (a baking tray works).

If an antenna needs an adapter, use one adapter, not a chain of them. Leave the lead slack where it meets the RTL-SDR, so the lead is not what holds the RTL-SDR up.

3 Connect the two RTL-SDRs

Plug each RTL-SDR into one of the USB extension cables (6 inches or longer), and each extension into a USB port on the Scanner. Keep the two a hand's width apart: side by side they interfere with each other.

Use the extension cables from the box. If you ever replace one, buy a **data** cable, 6 inches or longer: a charge-only cable lights the RTL-SDR up and the Scanner never sees it. It does not matter which USB port each one goes in; it does matter that each stays on its own antenna.

4 Power the Spotter

Plug the Spotter's cable into any USB charger, or into a spare USB port on the Scanner. Its antenna goes flat against a window if one is near.

5 Power the Scanner and wait two minutes

Plug in the 5 V / 5 A supply. A red light comes on, a green one flickers while it starts, and the fan may run. There is no switch and no screen. Give it two full minutes the first time.

The green light settles to an occasional flicker once it has started. The scanner software starts by itself every time the Scanner gets power; there is nothing to log into and nothing to shut down.

6 Pair the Scanner

In the Wavelens app: **More → Companion radio → Find**. The Scanner appears as *Wavelens-* followed by four characters. Tap **Pair**. From now on it reconnects by itself whenever it has power and the app is open.

Stand within a few metres for this first pairing. The Scanner becomes the main companion: it carries the scanner audio and the sensor decoder.

7 Pair the Spotter

If the Spotter is on its own charger, tap **Find** again, choose it and tap **Pair**; it becomes the second companion. If it is plugged into the Scanner, skip this step: it shows up on the Scanner's hardware line within a few seconds.

8 Check the radios and the area

On the Companion radio screen, the hardware line should read *2 RTL-SDR*. The kit is set up for the postcode you gave when you ordered. If you will use it somewhere else, change it on the admin page (step 10) under **Area**: a two-letter country and a postcode.

9 Scan

Open the **Scanner** tab and tap **SCAN**. The first lock takes 30 to 90 seconds while it finds your area's control channel; after that it is remembered. You should hear dispatch traffic. If your area's system is encrypted you will see talkgroups and their names and hear nothing, which is correct. Indoors, reception is weaker than it will be with the antenna on a roof.

10 Open the admin page once

The Scanner joins the Wi-Fi network you gave at checkout. On a phone or computer on that network, open `http://wavelens.local:8080` and set a password. That page is for updates, Wi-Fi, area, settings and logs. Nothing on it is needed day to day.

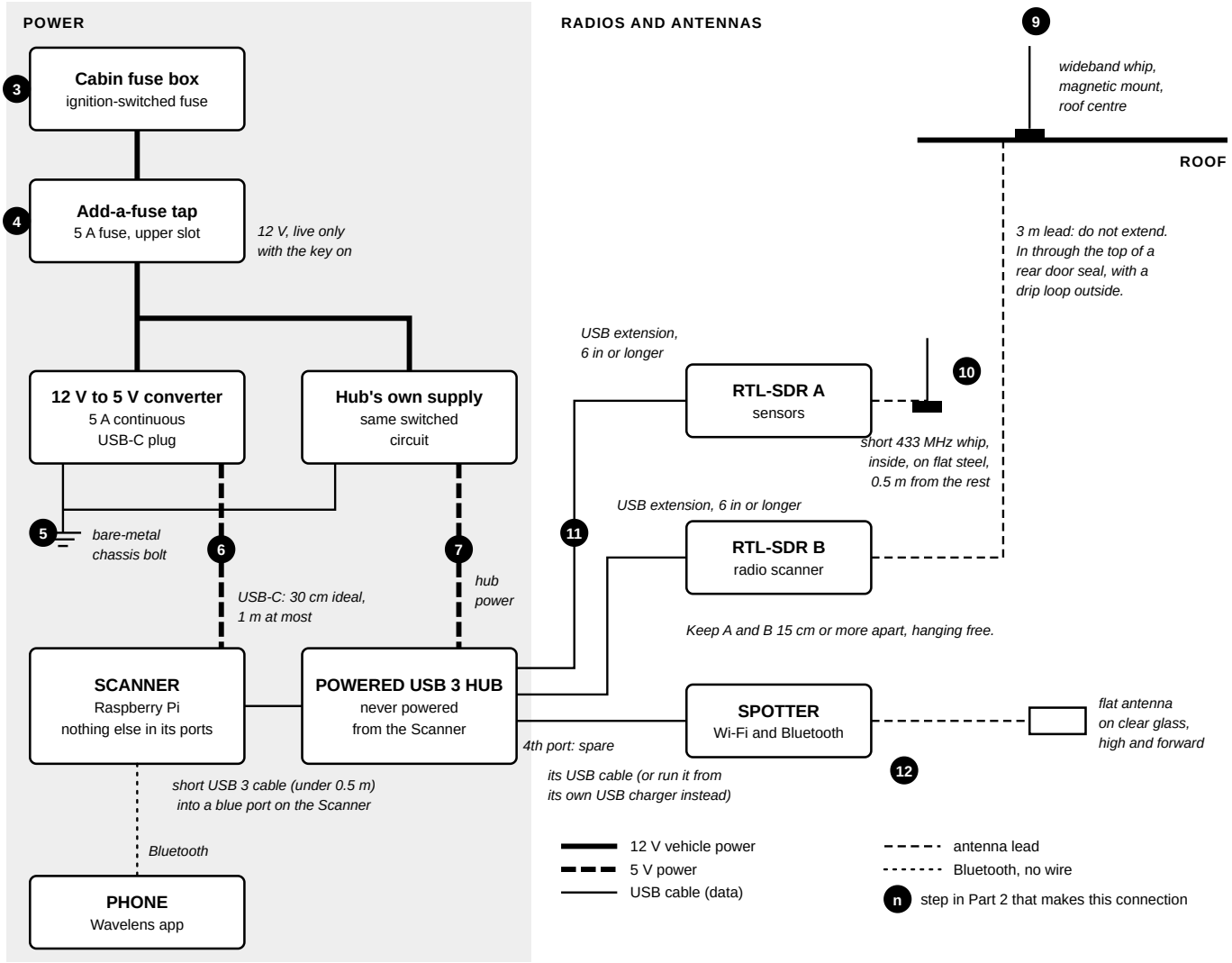
If that name does not open (some Android phones cannot look up `.local` names), use the address shown on the Companion radio screen's hardware line, followed by `:8080`. Part 4 of this booklet goes through every page. The Scanner needs Wi-Fi only to update, never to scan: on the road it talks to your phone over Bluetooth and nothing else.

What normal looks like

- **One RTL-SDR is hot and the other is cool.** The one that is sweeping works all the time and is hot to the touch; the other only warms up while it is playing a channel. Both are fine.
- **The fan runs on and off.** Keep the case's vents clear.
- **Nothing is heard for a while.** Radio traffic comes in bursts. A quiet minute on a quiet night is not a fault.
- **The app says "connected" within two minutes of power.** If it takes longer every time, see the table further down.

Part 2: install in a vehicle, step by step

Plan on an afternoon. Work in this order: power first, because every power problem looks like a radio problem; antennas second; cables and tidying last. Each step has more detail in the vehicle installation guide at **wavelensapp.us/install.html**.



Vehicle wiring. Each numbered dot is the step in Part 2 that makes that connection.

How to read the diagram

- **Two separate 5 V feeds come off one switched 12 V wire:** one converter for the Scanner, and the hub's own supply. The hub is never powered from the Scanner.
- **Everything USB goes into the hub,** and one short cable takes the hub to a blue USB 3 port on the Scanner. Nothing else plugs into the Scanner.
- **Each radio has its own antenna.** Do not join two radios to one antenna with a splitter: it costs signal and lets each radio's noise into the other.
- **The phone has no wire.** It talks to the Scanner over Bluetooth from anywhere in the vehicle.

Hub port	What plugs in	Cable	Why it is on its own cable
1	RTL-SDR A (sensors)	USB extension, 6 inches or longer	Sits with its small whip, away from B and the Scanner
2	RTL-SDR B (radio scanner)	USB extension, 6 inches or longer	Sits where the roof lead ends, so the antenna lead stays at 3 m
3	Spotter, if you run it from the hub	Its own USB cable; add a 1 to 2 m extension to reach the dash	The Scanner runs it over the cable and passes on what it hears
4	Spare		Room for another radio later

1 Lay it all out loose

Before fixing anything: Scanner and hub under a seat or in the glovebox, out of the sun; roof antenna where its 3 m lead reaches the cabin without an extension; the small antenna on the rear deck or dash; Spotter high on the dash. Check you can still reach the Scanner's ports.

Under the front passenger seat is the usual place for the Scanner and hub: cool, out of sight, and close to both the fuse box and the rear door where the roof lead comes in. RTL-SDR **B** goes where the roof lead ends (rear-seat floor or parcel shelf is typical) and USB runs from there. Your phone can be anywhere in the vehicle.

2 Buy the power parts

A 12 V to 5 V converter **rated 5 A continuous** with a USB-C plug ($12 to $25); a **powered** USB 3.0 hub with its own supply ($20 to $30); an add-a-fuse tap for your fuse size with a 5 A fuse ($6 to $10); a ring terminal and two metres of 16 to 18 AWG wire. Never an unpowered hub, and never a 2.4 A lighter plug.

If you buy extra USB cables, check they are data cables. Charge-only cables are the most common reason a kit that worked on the table does not work in the car.

3 Find an ignition-switched fuse

In the cabin fuse box, with a test light or multimeter, find a fuse that is dead with the key off and live in Accessory or Run: the 12 V socket and the radio are good candidates. Avoid airbag, ABS, engine-control and lighting circuits, and anything rated under 10 A. The kit should switch off with the ignition, so it cannot flatten the battery.

The fuse box is usually in the driver's footwell or behind a panel at the end of the dash; the owner's manual has the map. Test on the small exposed metal points on top of each fuse. Do not use a fuse that is live all the time.

4 Fit the add-a-fuse

Pull that fuse and seat it in the tap's lower slot, so the original circuit keeps its own fuse. Put the 5 A fuse in the upper slot and plug the tap in. Check with the meter: the tap's wire is dead with the key off and shows 12 V with it on. If it is live with the key off, turn the tap around.

Which way round the tap sits matters: its wire must be on the side of the slot that is live with the key on.

5 Ground the converter

Fix the converter's negative wire, with the ring terminal, under a bare-metal chassis bolt near the fuse box. Scrape paint if you have to. A poor ground is the usual reason a converter gives 5 V on the bench and 4.6 V in the car.

6 Run the converter to the Scanner with a short cable

Connect the converter's positive wire to the tap, and its USB-C plug to the Scanner. Keep that USB-C run short: 30 cm is ideal and 1 m is the limit. A long, thin cable loses a quarter of a volt at full load, and the Scanner notices.

If your converter has a bare 5 V output and you are fitting the plug yourself, set it to 5.1 V under load.

7 Power the hub from its own supply

Feed the powered hub from the same switched circuit through its own supply. The hub must never draw its power from the Scanner. Plug the hub into one of the Scanner's blue USB 3 ports with a cable under half a metre.

A hub that takes 12 V goes straight onto the same add-a-fuse wire and the same ground. A hub that takes 5 V gets a second converter of its own. Then check the order things start in: turn the key to Accessory, and the hub's light should come on with, or before, the Scanner's red light. On the same switched circuit this happens by itself.

8 Fix the Scanner and hub in place

Under a seat or in the glovebox, with hook-and-loop tape or a cable tie through the case. Keep the fan vents clear and slide the seat through its full travel to make sure nothing is pinched.

A glovebox suits small cars; leave the fan intake clear and do not pack the RTL-SDRs in beside it. If the floor ever gets wet, tie the Scanner to the seat frame so it sits a few centimetres up.

9 Put the scanner antenna on the roof

Set the magnetic mount near the centre of the roof on clean paint. Bring the lead in through the top of a rear door seal, with a small downward loop outside so rain drips off before the seal. Do not extend the lead. Screw it onto RTL-SDR **B**, finger-tight.

The section after these steps, **Roof antenna: mounting and keeping water out**, goes through this job in full. Between the rear doors, or just ahead of the rear glass, is nearly as good as the centre and keeps the lead short. A magnetic mount will not hold on an aluminium or composite roof: use a hatch-lip or boot-lid mount there. Do not let a door close hard on the lead; it is thin, and a crushed section is a dead antenna. One adapter at most between the lead and the RTL-SDR.

10 Place the sensor antenna inside

Stand the small 433 MHz whip on flat steel inside the cabin (rear deck or dash), half a metre from the other radios, and connect it to RTL-SDR **A**.

Your own wheels are two metres away and loud, so this antenna does not need to be outside. If the rear deck is plastic, a steel washer under the carpet gives the magnet something to hold.

11 Connect the RTL-SDRs to the hub

Each RTL-SDR on its own USB extension, 6 inches or longer, into the hub, 15 cm or more apart, hanging free, not taped to the Scanner or to each other.

12 Mount the Spotter

High and forward: top of the dash or an A-pillar, antenna flat against glass that has no metallic tint. Power it from the hub or from its own USB socket.

Not behind the dotted black band around the mirror, and not on heated glass if you have a choice. There are two ways to run it, and you can change your mind later. **On its own power** (a car charger or power bank), it pairs to your phone as the second companion and keeps working with the phone outside the car; use this with an iPhone or iPad. **Plugged into the hub**, there is no pairing: the Scanner runs it and your phone holds one Bluetooth link, which helps when the phone is already busy with earbuds, a watch or the car.

13 Tie everything down, with slack

Leave 10 cm of slack at every plug, then tie cables so nothing swings or sits under a foot. A plug that works loose looks exactly like a radio fault.

Each RTL-SDR should hang free on its cable, not pressed into carpet or against the other one. A loop of hook-and-loop tape to the seat frame keeps a cable from being kicked.

14 Turn the key and test

Key to Accessory, wait two minutes. The hub lights, the Scanner starts, and the app reconnects by itself. The hardware line should still read *2 RTL-SDR*. Tap **SCAN**.

15 Check the power under load

With the engine running, the scanner playing and the headlights and fan on, open the admin page (at home, on Wi-Fi) or watch the app for ten minutes. No under-voltage warning, no restarts, both radios still listed. If the Scanner restarts when you start the engine or hit a bump, go back to steps 2 to 6: it is the supply, the ground, or the cable.

16 Switch off and on again, then drive

Turn the ignition off, wait ten seconds, and on again: the Scanner should be back in the app within two minutes without you touching it. Then take a short drive. Part 3 checks each radio in turn.

Roof antenna: mounting and keeping water out

The roof antenna is the only part of the kit that lives outside. The whip, its magnetic base and the lead are made for weather. **Nothing else is: the RTL-SDRs, the hub, the Scanner and the Spotter must stay inside and dry.** The job has two halves: put the antenna where it hears best and stays put, and make sure the lead does not carry water into the cabin.

Mounting

1. **Pick the spot**

   The centre of the roof is best: the steel roof works as part of the antenna, and the centre gives an even view in every direction. Between the rear doors or just ahead of the rear glass is nearly as good and keeps the lead short. Stay a hand's length or more from a sunroof, roof rails, a roof box and other antennas.

2. **Check the magnet will hold**

   Try a fridge magnet on the spot. If it does not stick, the panel is aluminium, glass or composite and a magnetic mount will not hold: use a hatch-lip or boot-lid mount instead. Do not put the base on a glass sunroof panel.

3. **Clean the paint and the base**

   Wash and dry the spot, and wipe the underside of the magnetic base. Grit trapped under the magnet is what scratches paint, not the magnet itself.

4. **Set it straight down**

   Lower the base flat onto the roof with the lead pointing toward the door you will bring it in through. To move it later, lift it off; do not slide it. Check that the whip is screwed firmly into the base and stands vertical.

5. **Lay the lead across the roof**

   Run it straight back to the top corner of a rear door, lying flat, with no loop standing up for the wind to catch. On a long run, a small piece of clear paint-protection tape every 30 cm stops the lead buzzing against the roof at speed. Do not drill the roof; the kit never needs it.

6. **Check it after the first fast drive**

   After the first motorway trip, check that the base has not moved and the whip is still tight. Check again after strong wind, and lift the antenna off before a brush car wash, a low car park or fitting a roof load.

Keeping water out

1. **Bring the lead in at the top of a rear door seal**

   Open the rear door and lay the lead across the rubber seal at its top corner, where the seal is soft and the door closes gently. Close the door slowly the first time and feel for resistance. The lead should be gripped, not flattened: a crushed lead is a dead antenna and a path for water. A rear hatch with a rubber grommet for wiring is a good second choice.

2. **Make a drip loop outside**

   Just before the lead meets the seal, let it dip a few centimetres below the point where it enters, then rise to the seal. Rain running along the lead drips off at the bottom of that loop and never reaches the seal. This one loop does more than any sealant.

3. **Make a second low point inside**

   Inside the cabin, let the lead drop below the RTL-SDR before it rises to it, and keep the RTL-SDR and its connector off the floor. If a drop ever does get past the seal, it stops at the low point and not in the connector.

4 **Seal the crossing if the seal no longer sits flat**

If you can see a gap either side of the lead, put a small bead of neutral-cure silicone where the lead crosses the seal and let it set with the door closed. If your order included the roof antenna kit, the sealant in the box is for this. Do not fill the door's own drain holes.

5 **Protect the whip's joint**

Where the whip screws into the base, a turn of self-amalgamating (self-fusing) rubber tape stretched over the joint keeps water and road salt out of the thread. Ordinary electrical tape lets go in the sun.

6 **Test with water before you trust it**

With the doors shut, pour a watering can over the roof above the door for a minute, or use a hose on a gentle setting. Open the door and feel the inside of the seal and the carpet below it. Dry means done. Damp means the lead is sitting in a fold of the seal: move it a few centimetres toward the corner and test again.

- **In winter and by the sea,** lift the base off every month or two, wipe the paint and the base, and put it back. Salt and grit collect under the magnet.
- **If the seal ever leaks after months of use,** the lead has usually worked its way down the door. Move it back to the top corner and remake the drip loop.

Part 3: prove the install, then drive

Ten minutes in the driveway, one radio at a time. Each check tests one part, so a failure tells you exactly what to move.

Check	How	Pass	If it fails
Power	Admin page, **Status**, after five minutes idling with everything plugged in	No under-voltage warning; temperature under 60 °C	Shorter USB-C cable; check the ground; make sure the hub is not drawing from the Scanner
Scanner antenna	Scanner tab, **Spectrum**, on your area's public-safety band (851 to 869 MHz in the US)	Control-channel lines at +25 dB or more	Top line near +10: the antenna is inside the metal, the connector is loose, or the lead is crushed
Sensors	Drive 50 m, or press the key fob near the car, and watch the Alerts journal	Your own four tyre sensors appear with pressures; the fob shows as a remote	The small whip is not on A, or its base is not on steel
Spotter	Turn on a phone hotspot, or hold a second phone with Bluetooth on at the end of the driveway	Seen within a few seconds	Antenna not on glass, or the Spotter is too low. Move it up
All three	HUD, **Rule hits**, after a lap of the block	Counts credited to the phone, the Scanner and the Spotter	A radio with zero hits is not paired or not powered
Ignition cycle	Key off, wait 30 seconds, key on, wait two minutes	The Scanner is back in the app by itself and locks within seconds	It is on an always-live fuse, or the hub powers up after the Scanner

The first drive

- Keep the phone in a dash mount with the screen on for the first trip, so you can watch what each radio adds. Scanning with the screen off works afterwards.
- The sensor radio will be the busiest in traffic: every car around you has tyre sensors. What matters is the ones that stay with you.
- The Spotter shows far more Wi-Fi than your phone did on its own. That is its antenna doing its job, not a fault.
- Follow mode on the Scanner tab holds your area's system through a drive. If you cross into another system's area, it locks on again in about a minute.

Part 4: the Scanner's web page

The Scanner has a small web page for looking after it. Nothing on it is needed day to day. It is there for Wi-Fi, updates, the area, settings, and a look at what the Scanner is doing when something seems wrong.

1. **Be on the same Wi-Fi as the Scanner**
   Use a phone or computer on your home network, with the Scanner powered and in range of that network. In a vehicle, that means parked at home.

2. **Open the address**
   In a web browser, type `http://wavelens.local:8080`. If it does not open, use the numbers shown on the app's Companion radio screen hardware line instead, for example `http://192.168.1.20:8080`, or look for "wavelens" in your router's list of devices.

3. **Choose a password, the first time**
   The first visit asks you to choose an admin password of 8 characters or more. Later visits ask for it; a login lasts 12 hours on that device. Write it in the table on this page. You can change it on the **Account** page.

4. **Read the Status page first**
   It is the page you land on. If anything is wrong, a red box at the top says what, in plain words, with the fix as a button.

Page	What it shows	When you would use it
Status	Whether the scanner software is running, whether your phone is connected, the radios it found and any that are missing, the Scanner's name, address, Wi-Fi, temperature, storage and time since it started. A banner when an update is waiting.	First stop for any problem. Buttons to restart the scanner software or reboot.
Logs	The last 300 lines of what the Scanner has been doing, refreshed every two seconds.	**Download full log** saves a file to email to support.
Settings	The name the app lists under Find, and the scanner software's options, each with its explanation.	Renaming the Scanner. Saving restarts the scanner software.
Area	Where the Scanner is used: a two-letter country and a postcode, any country.	After moving or when travelling. **Set area and download** fetches the public licence records around that place, where a country publishes them, so signals are named by who holds the licence. Needs Wi-Fi.
Update	The installed version and the newest one.	**Check now**, **Install update**, **Roll back to previous**, and a box to install updates automatically overnight.
Wi-Fi	Networks nearby and the ones saved.	Joining a new network or forgetting an old one. Do this on your home Wi-Fi, not public Wi-Fi.
Spotter	Each Spotter plugged into the Scanner, whether it is working, and its job.	Changing a Spotter's job, or updating a Spotter that is plugged in.
Power	Restart the scanner software, restart this page, reboot, shut down.	Each asks you to confirm.
Account	Change the password; log out.	

Your Scanner's details

Fill this in the first time you set the Scanner up, and keep it with the kit.

What	Value	Where it comes from
Bluetooth name	Wavelens-_____	Shown in the app under Find
Web page address	`http://wavelens.local:8080` or `http://`_____`:8080`	The numbers are on the app's Companion radio screen
Web page password	_____	You choose it on the first visit (8 characters or more). There is no default. If it was set for you before shipping, it is written here.
Scanner login (advanced, below)	User `wavelens` Password `wavelens`, until you change it	The same on every kit as shipped. Change it.

Advanced: logging in to the Scanner itself

You never need this to use the kit. It is for people who want a command line on the Scanner, and for support when we ask you to run a command. The Scanner is a small Linux computer and accepts a remote login (SSH) from your home network.

1. **Open a terminal on a computer on the same Wi-Fi**
   On Windows open PowerShell; on a Mac or Linux open Terminal.

2. **Log in**
   Type `ssh wavelens@wavelens.local` and press Enter. The first time, answer `yes` to the question about the host. The user is `wavelens` and the password, as shipped, is `wavelens`. Nothing shows on screen while you type a password.

3. **Change the password straight away**
   Type `passwd`, enter `wavelens` as the current password, then a new one of your own, twice. Every kit ships with the same login, so until you change it anyone on your Wi-Fi who has read this page can log in to your Scanner. Write the new one in the table above.

4. **Log out**
   Type `exit`. The scanner software keeps running whether or not anyone is logged in.

This login and the web page password are two separate things: changing one does not change the other. If you forget the web page password, log in this way and email support for the reset command. If you forget both, email **wavelensapp@gmail.com**.

If the Status page shows a red box

What the box says	What to do
This version of the scanner software doesn't run on this Pi.	Press **Put the previous version back**, or **Install the latest update** if there is no previous version.
Some of the scanner software's files are missing.	Press **Install the latest update**. It reinstalls everything and checks the result.
A radio dongle isn't answering.	Unplug each RTL-SDR, wait five seconds, plug it back in. It is picked up within ten seconds.

The Pi's Bluetooth isn't working.	Press **Reboot**. If it is the same afterwards, take the power off for ten seconds.
The scanner software keeps stopping and restarting.	Press **Restart the scanner**. If it stops again, **Put the previous version back**.

Every red box also has **Download log for support**. Email that file to **wavelensapp@gmail.com**. If an update does not start, the Scanner puts the last working version back by itself and the Status page says so; there is nothing for you to do.

If something is wrong

What you see	Most likely	Do this
The Scanner restarts, or a radio disappears from the hardware line	Power: the supply is under 5 A, the USB-C cable is long or thin, or the ground is poor	Fit a 5 V / 5 A supply with a short cable; in a vehicle, redo steps 2 to 6
The hardware line reads *1 RTL-SDR*	A loose plug, an unpowered hub, or a power dip that upset one radio	Reseat both RTL-SDRs, then switch the power off and on
The app cannot find the Scanner	It is still starting, or out of Bluetooth range	Wait two full minutes after power; stand within a few metres for the first pairing
SCAN finds nothing	The antenna is indoors or inside the car's steel, or the area is set for somewhere else	Put the roof antenna outside; check the area on the admin page
Talkgroup names appear but no sound	That system is encrypted	Nothing to fix: it can be seen, not heard
The Scanner restarts over bumps or at idle	The supply is sagging, the ground is poor, or the USB-C cable is long	Measure 5.0 V or more at the Scanner under load; shorten the cable; remake the ground
The hub lights but the Scanner is dead	The add-a-fuse is in backwards or in the wrong slot	Its wire should be live only with the key on; turn the tap around
Whistles or a row of evenly spaced lines on the Spectrum view that appear with the engine	Electrical noise from the alternator or ignition on the 12 V wire	Clip-on ferrites on the 12 V lead and on the Scanner's USB-C cable; move the converter away from the RTL-SDRs
Scanner audio breaks up after an hour in the sun	The RTL-SDRs are too hot	Move them out of direct sun and away from the Scanner
Heard everything in the driveway, little on the road	The roof antenna slid, or its lead was pinched in a door	Reseat the base; route the lead through the top corner of the seal with a drip loop
The Spotter hears nothing at 5 GHz	Metallic-tint or heated glass	Move its antenna to plain glass, often a strip at the top of the windscreen, or a side quarter window
Scanner audio stutters on the phone	The phone's Bluetooth is busy	Plug the Spotter into the hub so the phone holds one link
`wavelens.local` does not open	The phone or computer is on a different network, or the Scanner is not on Wi-Fi	Use the address shown on the Companion radio screen's hardware line

Updates and care

- **Updates** arrive when the Scanner is on your home Wi-Fi. The app's Companion radio screen shows when one is waiting and installs it with one tap; so does the admin page.
- **Moving house or travelling:** change the area on the admin page so signals are named for where you are.
- **Every start is automatic.** Key on, two minutes, and the Scanner is back in the app. Key off and it is gone. There is no shutdown routine; the memory card is built for it.
- **Moving it between vehicles:** unplug the hub's power and the roof lead and lift the Scanner, hub and radios out together. The add-a-fuse and converter stay with the car.
- **Washing the car:** lift the magnetic mount off first, or hand-wash around it. A brush wash will take it.
- **Heat:** keep the Scanner out of direct sun. A black case on a dashboard in summer gets hot enough to make the radios drift.
- **The law:** the kit only receives. Rules on scanner radios in vehicles differ between countries and between US states; check yours.

Help

Email **wavelensapp@gmail.com** with what you see on the Companion radio screen's hardware line. That one line tells us most of what we need. More answers are on the support page, **wavelensapp.us/support.html**.

Checklist

- [ ] Ignition-switched fuse found: tap wire dead with the key off, 12 V with it on
- [ ] Add-a-fuse fitted with a 5 A fuse; ground on bare chassis metal
- [ ] Converter (5 A) to the Scanner's USB-C, cable under 1 m
- [ ] Powered hub on its own supply, same switched circuit, lights with or before the Scanner
- [ ] Scanner and hub fixed under a seat or in the glovebox; fan vents clear; seat travel checked
- [ ] Hub to a blue USB 3 port on the Scanner, cable under 0.5 m
- [ ] Roof whip near the roof centre; lead through the rear door seal with a drip loop; finger-tight on RTL-SDR B
- [ ] Small 433 MHz whip on steel inside, on RTL-SDR A, half a metre from everything else
- [ ] Each RTL-SDR on its own USB extension (6 inches or longer), 15 cm apart, hanging free
- [ ] Spotter high on the dash, antenna flat on plain glass, powered
- [ ] 10 cm of slack at every plug; everything tied so nothing swings
- [ ] Scanner paired as the main companion; Spotter as the second, or plugged into the hub
- [ ] Hardware line reads 2 RTL-SDR; SCAN locks and plays
- [ ] Own tyre sensors in the journal; hotspot seen by the Spotter; Rule hits from all three
- [ ] Ignition cycle: Scanner back in the app by itself within two minutes
- [ ] Admin password set on home Wi-Fi; automatic updates on

More detail online

Online, with more detail: the full vehicle installation guide: layout drawing, antenna placement with measured differences, noise and heat fixes, and adding radios later.
wavelensapp.us/install.html

Online, with more detail: support, questions and answers. Or email wavelensapp@gmail.com.
wavelensapp.us/support.html