

TS-890S Desktop Front Panel

User guide — version 2.4

This is a guide to the desktop application that puts a working front panel for the Kenwood TS-890S on your computer screen. It is written for somebody who has never used it before. It assumes you can operate the radio itself, and nothing else.

Everything here describes the application, not the radio. Where the two differ — and they do in a few places — the guide says so.

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Looking for one thing? The index at the back lists the main words and every page they are on, and every page number in it and here is a link. In a PDF reader, Ctrl+F searches the whole guide.	

1. What this is, and what you need

The application is a front panel. Every key, knob and meter you see is drawn on purpose to look and behave like the real thing, and the clusters of controls can be moved, resized, hidden and saved in layouts of your own. It is not a web page in a window and it does not need a browser.



The main window as a new installation opens it. Across the top: the analogue S-meter, the frequency, the clock, RIT/XIT and D.VOX, then power, MIC and DELAY over the filter scope. Below: the bandscope and waterfall, the radio's own controls around the tuning knob, and the audio scope along the bottom.

What it talks to

Two links, doing different jobs:

- **USB** carries the control commands (CAT) and the audio. One cable from the radio's USB socket to the computer.
- **LAN** carries the bandscope. The radio can send its scope picture down the USB port as well, but twenty sweeps a second will not fit through 115200 baud, so the network link is what makes the display smooth.

The LAN side is optional. Without it everything else still works; you just get a slower bandscope, or none.

There is also a third way: **remote operation**, where the radio's network port carries everything and the USB cable is not used at all, so you can operate from a laptop elsewhere. Section 24 explains it.

Some windows also use the internet, and only when you open them or switch them on: QRZ.com and Logbook of the World for your QSOs, PSK Reporter for who is hearing you, the DX cluster for spots, and the space-weather and ionosonde services for propagation. Each one is described in its own section, with where its information comes from. Nothing about your radio is sent to any of them.

Before you start

- The radio's USB port connected to the computer, and its virtual COM ports installed. Windows will show two of them.
- The radio's CAT baud rate set to **115200** (menu 7-00). Anything slower and the scope streams will not run at all.
- If you want the LAN bandscope: the radio on your network, and the KNS user name and password you set on the rig.

Installing

The Windows download is the **installer**, *TS-890S-Desktop-<version>-setup.exe*. Run it, and it puts the program in place, adds it and this guide to the Start menu, and can be removed again from Windows Settings. It installs for you alone without asking for an administrator, or for everybody on the computer if you choose that on its first page.

The installer for a new version removes the old one first, so there is only ever one copy on the computer. It will not put an older version over a newer one: updates only go forward. There is no portable zip from version 2.4.4 on.

Your settings live in your own Windows profile, not beside the program, so upgrading or uninstalling leaves them alone.

On a Mac

The Mac download is a disk image, *TS-890S-Desktop-<version>-macos.dmg*, for Apple silicon and Intel Macs on macOS 13 or later. Open it and drag **TS-890S Desktop** onto the Applications folder beside it.

The application is not signed with an Apple Developer ID, so the first time you open it macOS says it cannot check it. On macOS 15 and later, try to open it once, then go to **System Settings** → **Privacy & Security**, scroll down and click **Open Anyway**. On macOS 14 and earlier, Control-click it in Applications and choose **Open**. You do this once.

macOS then asks whether it may use the **microphone**: say yes — that is how it hears the radio's USB audio, and without it every scope and decoder is silent. It may also ask about the **local network**, which is the LAN bandscope.

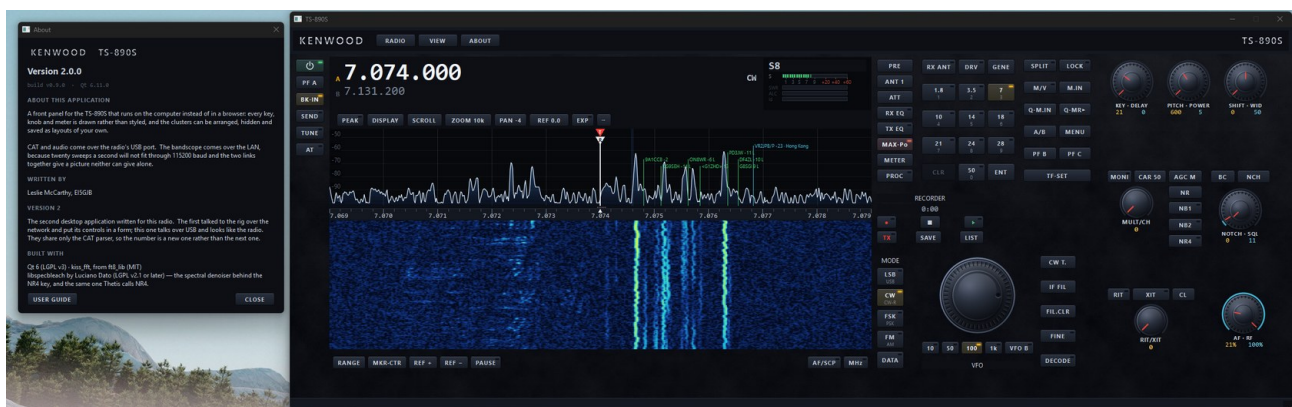
The radio's USB ports appear as */dev/cu.SLAB_USBtoUART...* or */dev/cu.usbserial-...*; pick the lower of the pair. If none appear, install the Silicon Labs CP210x driver for macOS. Sharing CAT over a virtual serial port is for Windows; on a Mac, give other programs the TCI server instead.

Finding this guide again

ABOUT, on the bar across the top of the window, shows the version and what the application is built with. Its **USER GUIDE** key opens this document.

The application is free to use, and free to pass on to anyone as the complete, unchanged download, but not for sale. The terms are in *LICENSE.txt* beside the program, and the licences of the components it is built on are in the *licenses* folder. If it has earned a place in your shack, the **DONATE** key in the same window opens a PayPal page.

Three weeks after it is first started, the application begins to remind you to consider a donation; after four weeks the reminders come every minute, and the first connection to the radio each time waits half a minute. Nothing else changes. A donation of EUR 20 or more gets you a licence key for your PC, which ends the reminders, with free updates for life. **ABOUT**, then **LICENCE KEY**, shows your PC's code: put it in the note with your donation, and enter the key that comes back by email in the same window. A key is for one PC and is personal to you.

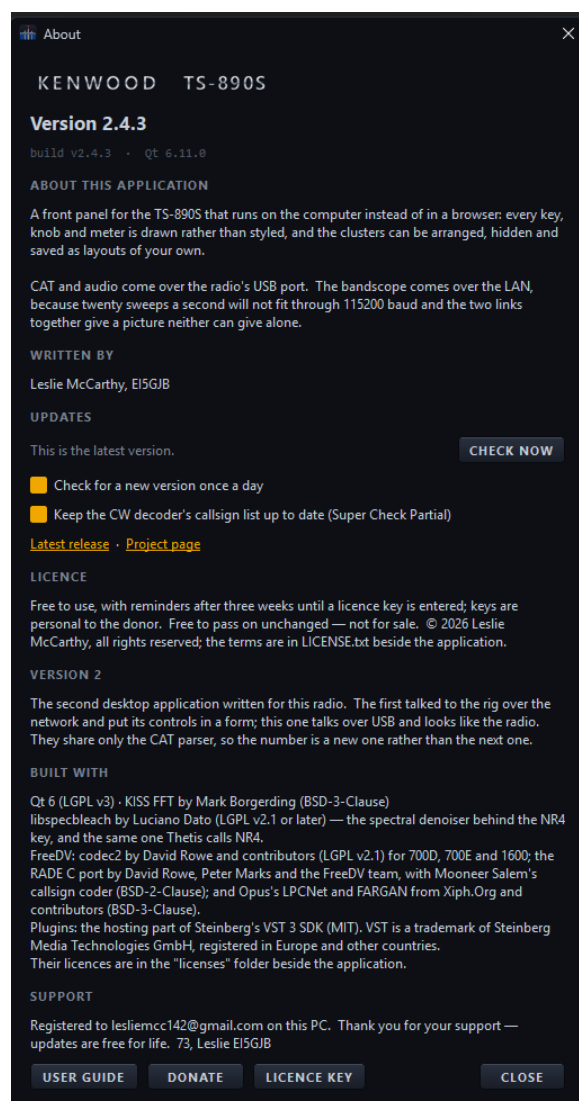


The About window, beside the main panel. USER GUIDE at the bottom left opens this guide.

Keeping up to date

Once a day the application asks GitHub, where the downloads are, which version is the latest. When a newer one is out, the log says so once, and the lamp on **ABOUT** lights amber until you have installed it. In the About window, under **Updates**:

Part	What it does
The line of text	Says whether a newer version is available, that this is the latest, or why the last check could not be made.
DOWNLOAD	Shown only when there is a newer version. Opens its download page in your web browser.
CHECK NOW	Asks straight away instead of waiting for the daily check.
Check for a new version once a day	Untick it and the application never asks by itself. CHECK NOW still works.
Keep the CW decoder's callsign list up to date	Lets the application fetch the list of callsigns the CW decoder uses to recognise real calls (section 7). Untick it and the copy already on your computer is used as it is.



The About window. Under UPDATES: this is the latest version, CHECK NOW, and the two switches — one for new versions, one for the CW decoder's callsign list — with the Latest release and Project page links below them. When a newer version is out, a DOWNLOAD key appears beside CHECK NOW.

Only the application's name and version number are sent, as GitHub asks every program to do. Nothing about you, your computer or your radio is sent. To update, install the new version over the old one: your settings and your logbook are kept.

The callsign list comes from the Super Check Partial database (supercheckpartial.com), the list of calls seen in contest logs, kept by W9KKN. The application checks for a new copy at most once a day and downloads it only when it has changed. As with the version check, only the application's name and version are sent.

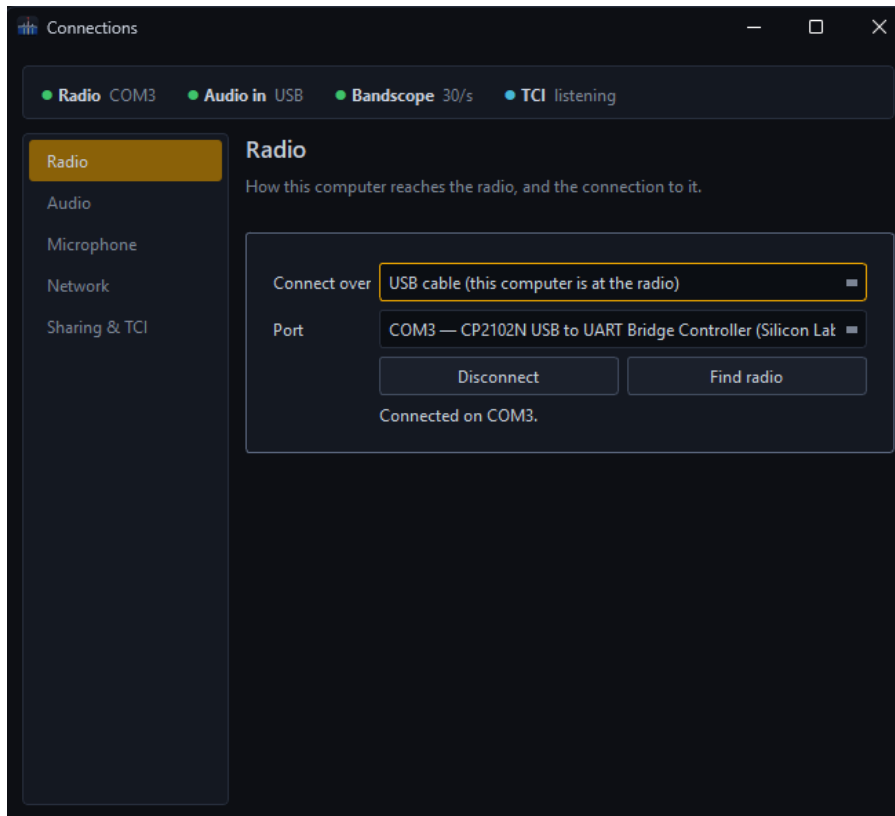
2. First run — the Connections window

Open **RADIO** → **Connections**, or press **Ctrl+K**. This is the only window you have to visit before anything works.

On a brand-new installation it opens by itself the first time, with a welcome line along the bottom of the main window. It will not do that again, and it does not appear at all for anyone who already has settings.

Along the top is a **status strip** with a lamp for each link: **Radio**, **Audio in**, **Bandscope** and **TCI**. Green is working, amber is trying or connected with nothing coming through yet, and grey is off; beside each, a word or two says more (the COM port, the sweeps per second, how many programs are on TCI). Below

it, the settings are in **pages**, listed on the left — **Radio**, **Audio**, **Microphone**, **Network** and **Sharing & TCI**. Click one to see it; the window remembers the one you looked at last.



The Connections window on its Radio page. Along the top, all four lamps green: the radio on COM3, audio coming in over USB, the bandscope at 30 sweeps a second and the TCI server listening. On the left, the pages.

The Radio page

The first line, **Connect over**, says how this computer reaches the radio. **USB cable** is the normal choice, when the computer is at the radio, and everything in this section is about it. **Network — remote operation** is for using the radio from somewhere else; see section 24. Under the keys, a line says in words what the connection is doing.

The radio shows up as **two** COM ports, and only one of them does CAT (the radio's “Standard” port). The other one, its “Enhanced” port, opens without complaint and then never answers. On it the app looks like it works: the bandscope and audio come in, but the frequency stays blank and the keys do nothing.

So press **Find radio**. The app asks each of the radio's ports “are you on?” and “who are you?”, picks the one that answers, and connects to it. It takes less than a second. It only asks; it never changes anything on the radio. Or pick the port yourself and press **Connect**.

Once it connects, the frequency display comes alive and the panel starts mirroring the radio within a second.

Find radio says	What to do
your radio. It answers CAT at 115200	Nothing. It is connected.
the radio's second (Enhanced) port	Nothing. That's the port that doesn't do CAT; the other one is used.
your radio, but its CAT speed is set to ...	On the radio, set menu 7-00 to 115200, then press Find radio again.
in use by another program	Another program has the port open. The app names it when it can, e.g. "Log4OM (its CAT is set to COM3)". Close it, or point it at this app's TCI server instead.
not checked, because the radio's other port is in use	The same: free the port the other program has, then try again.
No radio ports found	Check the USB cable, that the radio is on at the mains, and that its USB driver (Silicon Labs CP210x) is installed.

Find radio runs by itself the first time the app starts, and again if a port opens but the radio says nothing for six seconds. It is careful with the radio: it only talks to the radio's own kind of USB port, and it never opens the second port once the first has answered or is in use, because that port can be set to key the transmitter.

The application only ever opens one port for control. It does not fight your logging program for it — see "The Sharing & TCI page" below.

The Audio page

Tick **Audio in** and choose the radio's USB audio input. This is what feeds the audio analyser and the CW, RTTY and PSK decoders.

Level in is a meter in dBFS — the scale every piece of audio equipment uses, where 0 is the ceiling. It shows three things: a bar that follows the signal, a marker that holds where the loudest recent peak was and falls back slowly, and a block at the right that lights red and *stays* red if anything has clipped. Click the meter to clear it.

Aim for peaks around **−12 dB** on normal receive audio. If the meter stays flat while the radio is receiving, the audio is not leaving the rig at all — look at menu **7-08, USB: Audio Output Level**.

Trim in makes up the difference between one sound card and another. Interfaces vary by 30 dB and more in how hot they present the same line level, and this is the place to correct that rather than turning the radio up until something distorts. It applies before anything else sees the audio, so the decoders, the scope, the recorder and the loudspeaker all get the same corrected signal.

The trim is a gain, not a rescue. If the clip flag is lighting, the signal is already too hot arriving — turn 7-08 down, or trim down, rather than trimming up.

Level out and **Drive out** are the same pair for the transmit side: what this application is sending into the radio, and how hard. Drive applies to the tune carrier, on-air playback and the RTTY and PSK transmitters alike, and it can be moved while a tune carrier is running. Set it with TUNE going and the rig's own ALC just starting to move.

Level out only moves while this application is sending audio to the radio — a tune carrier, the microphone, a recording, RTTY or PSK. Moving **Drive out** with nothing being sent does not move it; when the sending stops, the bar falls back by itself.

Tick **Listen** to hear the radio through the computer, and pick which of the computer's outputs to hear it on. This is separate from everything else: enabling the radio's USB codec in Windows gives you a recording device, and nothing on a PC sends a recording device to a loudspeaker by itself, so without **Listen** the audio arrives, feeds the decoders and the scope, and is never heard.

Listen volume is this computer's volume. The AF knob on the panel sets the RADIO's volume — a different thing, and it does not move this one. The radio's own codec is deliberately not offered as a listening device: sending receive audio there would feed it back into the transmit path.

MUTE, on the bar across the top of the main window, silences the radio's audio through the computer with one press, without unticking Listen or moving its volume; its lamp is lit while muted. Press it again for the sound back. A remote receiver (section 14) is still heard, so you can listen to one in a headset with the radio quiet, and the decoders, the scopes and recordings carry on as usual. The application always starts unmuted.

Choose the radio's USB audio output as the **Audio out** device if you want the application to be able to transmit tones or send RTTY and PSK. The **Test** button beside it checks that device will accept transmit audio without keying anything.

The Microphone page

Your voice on the air through this computer: tick **Mic in**, pick the microphone and set its level. Section 9 explains it, with FreeDV.

The Network page

Enter the radio's IP address and your KNS user name and password. Choose the scope speed under **Sweeps** — **LAN · High** is the one worth having. In remote operation the same page holds the address of the radio or of the Remote Relay (section 24).

The address, user name and password are kept for you by Windows, in Credential Manager, or on a Mac in your Keychain, like your QRZ.com and LoTW logins. The password is not in the settings file, and the login stays even if the settings are lost. On a Mac, after installing a new version, macOS may ask once whether TS-890S Desktop may use it: choose **Always Allow**.

With no network connection to the radio, set **Sweeps** to **USB · DD2** or **USB · DD4** instead. The picture then comes down the USB cable, more slowly. Leave the address blank with a LAN choice selected and the bandscope stays empty — it says so on the scope, and why.

The Sharing & TCI page

The application can pass CAT through to another program (a logger, a contest program) over a virtual serial port, and it can run a TCI server that programs such as Log4OM and MSHV understand. Both are switched on here. If you do not use either, leave them off.

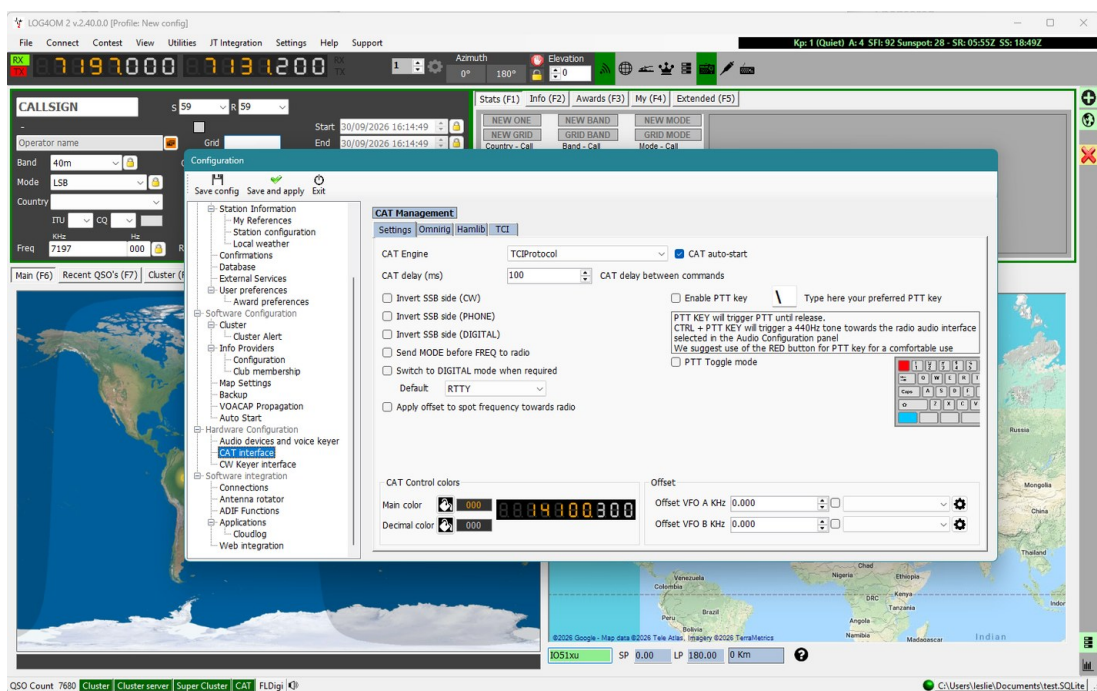
A program on the shared port sees an ordinary Kenwood CAT port, and is treated like one:

- it gets the answer to each question it asks, and nothing else — the radio's automatic updates only if it asks for them itself (AI);
- its AI setting is its own: it cannot switch off the updates this application relies on;
- if it starts before this application has connected to the radio, its questions wait and are answered as soon as the radio is ready — there is no need to start the two in a particular order;
- while you tune, it is still answered a few times a second, so it follows the frequency; and its transmit commands go straight through, like a key pressed on the panel.

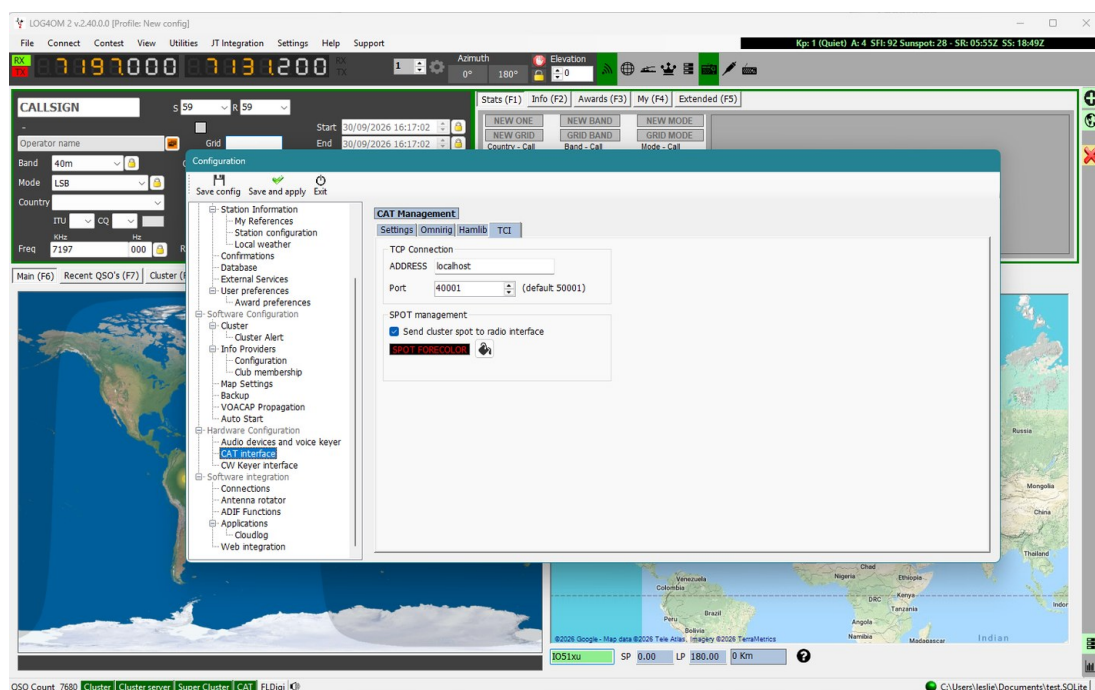


Sharing in use: Log4OM and WSJT-X following the radio on 40 m FT8 while the panel runs alongside — a client on the shared CAT port (COM11) and another on the TCI server.

To put **Log4OM** on the TCI server, open its **Settings** → **Program Configuration** → **CAT interface**. On the **Settings** tab, set **CAT Engine** to **TCIPProtocol**. On the **TCI** tab, set the address to **localhost** and the port to the one this application's TCI server shows (40001 unless you changed it). Then **Save and apply**.



Log4OM's CAT interface, Settings tab: CAT Engine set to TCIPProtocol.



The TCI tab beside it: address localhost, port 40001 — the same port as the TCI server here. With *Send cluster spot to radio interface* ticked, Log4OM's cluster spots appear on the bandscope too.

If you close and restart the application, the TCI server starts again by itself, but some programs do not reconnect on their own. Log4OM is one: reconnect it with **Connect** → **CAT** → **Start CAT** in Log4OM, or start this application before Log4OM.

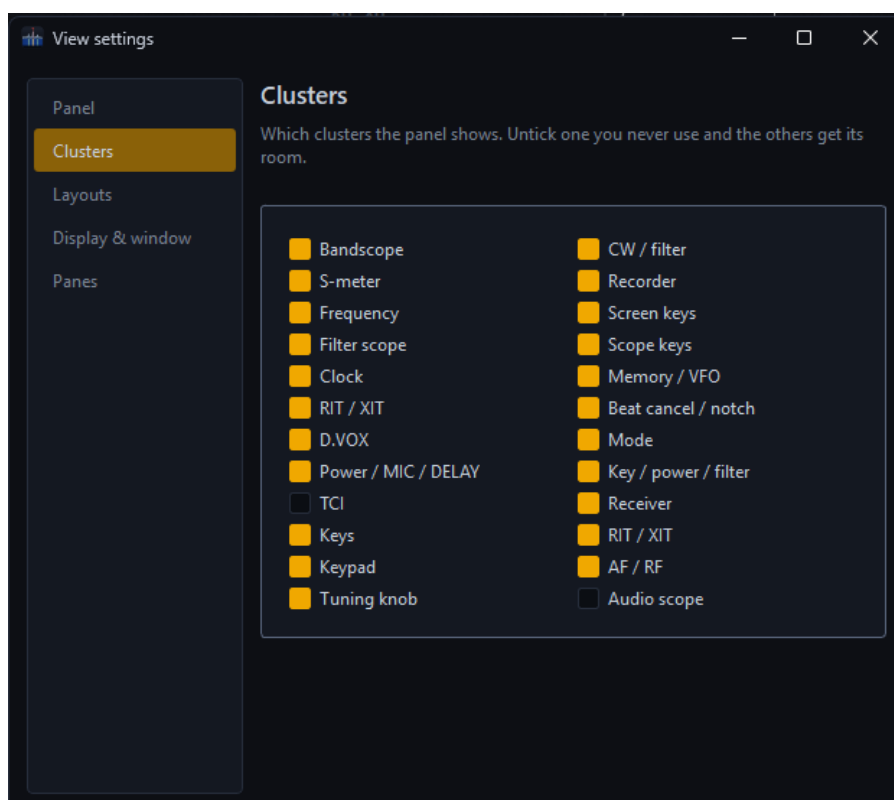
3. The panel, and making it yours

The main window is one large panel made of clusters: the keypad, the mode column, the tuning knob, the meters, and so on. The first time the application starts, it opens in a ready-made layout called **Default-Layout-v2.2.2**, the one in the picture in section 1, with the bandscope and the audio scope large and the controls around them. A second one, **No-AudioScope-Layout-v2.2.2**, is the same without the audio scope, which gives the bandscope more room. Both are listed under **VIEW** → **Layouts** like any layout of your own, so you can always go back to them.

VIEW and View settings

VIEW, on the bar across the top, holds what you reach for while operating: **Arrange panel** (Ctrl+E), **Tidy up** (Ctrl+Shift+E), **Layouts** and **Lock window size**. Everything else about how the application looks is in **VIEW** → **View settings** (Ctrl+Shift+V), a window laid out like Connections, with its pages on the left:

Page	What is on it
Panel	Show hints and cluster frames; Arrange panel; Tidy up, Rig layout and Compact layout.
Clusters	A tick box for every cluster on the panel.
Layouts	Your saved layouts, with the one in use marked: use, save, rename and delete them.
Display & window	Display size and Fit to this screen; Lock window size, Window size and Reset dock layout.



View settings on its Clusters page: a tick for every cluster the panel shows. Here TCI and the audio scope are hidden.

The tick boxes and buttons in View settings are the same switches as the menu items they replace, so they keep their settings, and the menu and the window always agree.

The RADIO menu

RADIO, beside **VIEW**, holds everything that is not a key on the panel, in four groups:

Group	What is in it
Set up	Connections; Set up the radio for FT8 or FreeDV; the Microphone and Listen Plugins ; the band plan; key bindings; and alerts.
On the air	The DX cluster, remote receivers and propagation.
Listening	Back; the broadcast schedule, bookmarks, the listening log, the recording schedule, signal history and the data decoders.
Backups	A backup now, and the backups folder.

The menu says what is going on. Anything running has a green lamp beside it, and a few words on the right: how many DX cluster sources are connected, when the next recording starts, how many plugins are on, or that the scanner is scanning. A **Set up the radio for** that has been applied and not yet put back is lit too, so you are reminded to undo it. **Back** says where it will take the radio.

Moving things around

Turn on **VIEW** → **Arrange panel** (or press **Ctrl+E**). While it is on you can:

- drag a cluster anywhere on the panel;

- drag its edges to resize it;
- right-click it to choose which window edges it sticks to when the window is resized;
- double-click its name to put it back where it started;
- press the small × to hide it.

Turn Arrange off again and the layout is saved. Nothing is lost if you make a mess: **Rig layout** (View settings → Panel) puts everything back, and **VIEW → Tidy up** (Ctrl+Shift+E) re-arranges what you have chosen to keep, without putting back what you hid.

Which clusters are shown

View settings → Clusters lists every one with a tick beside it. Turn off the ones you never use and the rest get the space.

Layouts

A layout is more than where the clusters sit — it also remembers the window size they were arranged for and whether the cluster frames are drawn. Save one with **VIEW → Layouts → Save current layout as** (Ctrl+Shift+S) and switch between them from the same menu, or from **View settings → Layouts**, which also renames and deletes them. A contest layout and a casual-listening layout are the usual pair.

Locking the size

Once a layout is right, **Window size** (View settings → Display & window) lets you type an exact size, and **VIEW → Lock window size** keeps it. After that the frame cannot be dragged, so a stray grab at an edge will not reflow everything you just arranged.

Fitting the screen

The application was arranged on a big monitor. On a laptop, especially a 13 or 14-inch one, where Windows also makes everything bigger (125 %, 150 % or more, under *Settings → Display → Scale*), it would not fit. So it makes itself fit, and in most cases you do not have to do anything.

The main window

- **The first time you start it**, it measures your screen. If the panel is too big, it draws the whole application smaller and restarts once, straight away. The panel then opens complete, in its usual arrangement, just smaller.
- **After that**, whenever the panel does not fit — when it starts, or straight away if you change Windows' scaling or drag the window to a smaller monitor — it asks **Fit to this screen?** and says how small it would draw it (for example 65 %). Choose **Yes** and it restarts at that size. Choose **No** and it leaves the size alone; tick **Don't ask again for this screen** if you do not want to be asked.
- **Whatever you answer**, the window is kept on the screen, with its title bar where you can reach it. If you had locked the window's size (**VIEW → Lock window size**) at a size bigger than the screen, it is unlocked for that session so it can fit, and locks again on a screen it fits.

To choose the size yourself, use **VIEW → Display size: Fit to this screen** works out the size for you, or pick 90, 80, 70, 60 or 50 % of normal. Everything shrinks together, so your layout keeps its shape. On a 13-inch laptop at 150 %, about **60 %** is usual.

A size chosen by hand takes effect the next time the application starts, so close it and open it again. To go back to normal, choose **100 %**.

All the other windows

The logbook, the PSK map, Remote receivers, the DX cluster, Propagation, the About box, the settings dialogs and the rest fit your screen by themselves:

- A window too big for the screen opens smaller, so it fits, with its title bar on the screen.
- If what is inside cannot be made that small, the window gets **scroll bars** instead. Scroll to reach the rest; nothing is hidden or cut off.
- On a big monitor they open exactly as they always have.

Plugin windows keep their own size: each plugin decides how big its window is.

Hints

Rest the pointer on almost anything — a key, a knob, a meter — and a short note appears saying what it does. They help while the panel is new to you. When you no longer need them, untick **Show hints** (View settings → Panel) and none appear anywhere. Tick it again to bring them back. The choice is remembered.

The top of the screen

Across the top of the panel are the readouts the radio has across the top of its own screen. Each one is a cluster of its own, so you can move it, resize it or hide it like any other (see “Moving things around” above).

Cluster	What it shows
S-meter	The radio's meter, with a moving needle. See below.
Frequency	VFO A and VFO B with their modes, and a line of status above and below them, as on the radio's screen. See below.
Clock	The radio's date and time. See below.
RIT / XIT	Whether RIT and XIT are on, and the offset: 0.000 when there is none, +0.120 or −0.120 when there is.
D.VOX	Whether DATA VOX is on, and which input it listens to: OFF, ACC 2, USB or LAN.
TCI	Which programs are connected to the TCI server. See below.
Power / MIC / DELAY	Transmit power, microphone gain and the delay, for example “5W MIC: 23 DELAY: 3”. While the speech processor is on, MIC gives way to PROC OUT , the processor's output level, as on the radio's screen (not in FM, where the radio keeps that level fixed). The MIC ring of the PWR · MIC knob then becomes PROC and sets it, as the radio's own MIC control does.
Filter scope	The receive filter and the audio inside it. See below.

The frequency display

The frequency display shows what the radio shows around its own frequency readout, laid out the same way.



The frequency display in CW with SPLIT on. Along the top: ANT 1, AGC-M, PRE OFF, ATT OFF and AT ▶ T, the antenna tuner in line. VFO A is on 7.024.134 in CW and VFO B on 7.131.100 in LSB, with the TX box beside B, the VFO you transmit on. Along the bottom: VFO, SPLIT and the offset between the two. CW TUNE, on the right, flashes while the radio's CW auto-tune is working.

Part	What it shows
Top line	ANT , AGC , PRE and ATT all the time, greyed when they are off. After them, only while they are on: the antenna tuner, RX ANT , NR , NB1 , NB2 , NOTCH , BC , PROC , RX EQ , TX EQ and MAX-Po .
The antenna tuner	AT ▶ T when the radio's tuner is in line for transmitting, and R ◀ AT ▶ T when it is in line for receiving too, as the radio shows it. It flashes while the tuner is tuning.
VFO A and VFO B	Each frequency with its mode and band memory beside it, such as CW BAND 1 . A TX box marks the VFO you transmit on; it fills in red while you are transmitting.
Bottom line	VFO , or the memory channel when you are working from memory; SPLIT and the offset between the two VFOs (ΔF); and TF-SET , RIT , XIT and LOCK while they are on.
CW TUNE	Flashes in the space on the right of the bottom line while the radio's CW auto-tune is working (the CW T. key, section 7).

The digits size themselves to fit the cluster, so you can make it as large or as small as you like and nothing is cut off.

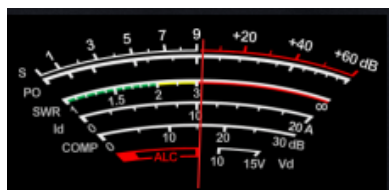
The S-meter

The S-meter looks and moves like the analogue meter on the radio's screen. While you receive, the needle shows the S-meter reading: it points at the same S-unit the radio does. It rises quickly and falls back more slowly, like a real meter.

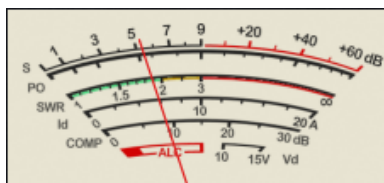
While you transmit, the needle shows the meter you have chosen with the **METER** key (below): output power (PO), ALC, SWR, COMP, Id or Vd.

Double-click the meter to change how it looks. Each double-click goes to the next of three:

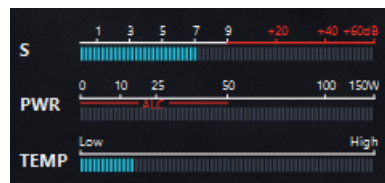
- the **dark** face, white scales on black;
- the **light** face, black scales on cream, like the radio's white meter;
- the **digital** meter: three bars, S, PWR and a third bar for the meter you have chosen with METER, like the radio's digital meter.



1. Dark face



2. Light face



3. Digital meter

The three looks of the S-meter. Double-click the meter to go from one to the next, and from the digital meter back to the dark face.

Reading the analogue faces (1 and 2). Both faces are the same meter in two colours. The top scale, **S**, is the one the needle uses while you receive: S1 to S9 in white or black, then +20, +40 and +60 dB over S9 in red. The scales underneath are for transmitting: **PO** (output power), **SWR**, **Id** (current), **COMP** (speech compression), **ALC** (the red band) and **Vd** (voltage). While you transmit, read the scale that matches the meter shown on the METER key.

Reading the digital meter (3). Each row is a bar that fills from the left. **S** is the signal you are receiving, on the same S1 to +60 dB scale. **PWR** is your output power while you transmit, from 0 to 150 W, with the ALC range marked in red. The third row is the meter chosen with METER — here **TEMP**, the radio's temperature from Low to High. TEMP is only on the digital meter, as on the radio.

The choice is remembered. If the meter is too small to read comfortably, drag its cluster bigger; the face grows with it and keeps its shape.

The METER key

METER, in the column of keys beside the bandscope, chooses which meter is shown while you transmit. Each press goes to the next one: PO, ALC, SWR, COMP, Id, Vd, then TEMP, then back to PO. The one chosen is shown on the key, under its name.

- **COMP** is only offered while the speech processor (PROC) is on, because the radio only offers it then.
- **TEMP** is the radio's temperature. It has no scale on the analogue face, so choosing it puts the meter on its digital look, with a TEMP bar from Low to High. The next press of METER goes back to PO and the needle.

METER here and METER on the radio are the same setting: press either one and the other follows within a couple of seconds.

The filter scope

The small scope at the top right is a copy of the filter scope on the radio's screen. It shows:

- which receive filter is in use, A, B or C, in the box at the top left;
- the filter's settings along the top: **LC** (low cut), **BW** (bandwidth) and **HC** (high cut), or **WIDTH** and **SHIFT** in CW and data;
- the filter itself, drawn as a white outline with sloping sides;
- the audio the radio is sending you, inside it;

The TCI cluster shows which programs are connected to the TCI server, each as a short tag: for example **L4OM** for Log4OM, **WSJT** for WSJT-X, **N1MM**, **JTDX** or **SKIM** for CW Skimmer. A program on another computer shows as the end of its network address, such as **.23**. If there are more than fit, it shows as many as it can and then the number left, such as **+2**. Rest the pointer on it for the full list.

It reads **OFF** when the TCI server is off, and **—** when the server is on but nothing is connected.

4. Tuning

The ways to tune

What you do	What happens
Drag the tuning knob	Tunes, at the step size lit on the keys under it.
Roll the mouse wheel over the knob or the bandscope	One step per detent. Hold Shift for one tenth of a step.
Click on the bandscope	Goes straight to that frequency.
Drag across the bandscope	Tunes as you drag — the marker follows the pointer. Dragging up and down at the same time moves the display's level window.
Ctrl + wheel over the bandscope	Changes the scope span (the radio's own zoom), not the frequency.
ENT on the keypad	Type a frequency and go there.

Step size

The four keys under the tuning knob — 10, 50, 100 and 1k — set what one detent is worth, in hertz. Whichever one is lit is exactly what you get. The choice is remembered between sessions.

For the finest tuning, press **FINE** in the column beside the tuning knob. While it is lit, every step is **1 Hz**. It is the radio's own FINE: press it here or on the radio and both follow. Pressing one of the step keys, or MHz, turns FINE off again.

Dragging the knob. Grab it near the edge and turn it round, as you would a real knob: clockwise tunes up. Grab it in the middle and drag up to tune up, down to tune down. It keeps to whichever you started with until you let go.

Band keys and the band stack

The band keys are laid out three across in frequency order, from 1.8 MHz to 70 MHz, including **5 MHz** (60 m) and **70 MHz** (4 m).

From 1.8 to 50 MHz they are the radio's own band keys, using the radio's own band memories — three for each band — so the panel and the radio always agree:

- **Press** a band key you are not on and you go to that band, to the band memory you last used there, mode and all.
- **Press** the band key for the band you are already on and you step to its next band memory, as on the radio.

- **Press and hold** a band key and a menu lists the band's three memories, with the one you are on marked. Click one to go to it. Below them are **Your saved spots**: five more slots of your own for the band, each holding a frequency *and* its mode.

A band memory shows what it holds once it has been used with the application running; until then it reads *not seen yet*.

5 MHz and 70 MHz have no band memories on the radio, so their keys use only the application's own five slots.

For your own slots, on any band, the menu lets you go to a slot, store the current VFO in one, or clear them. They are remembered between sessions.

The mode is stored with the frequency because 7.040 in CW and 7.040 in LSB are different places. A memory that recalls the frequency and leaves you in the wrong mode has done half the job.

Modes

The MODE column shows which mode you are in rather than only what each key does: in USB the top key reads **USB** in full size with LSB as a small marking underneath, and the other way round in LSB. The DATA key names the data mode actually running — USB-D, LSB-D and so on.

A band key also carries the mode. The first time you visit a band you get that band's normal sideband (and CW on 30 m, which is CW and data only). After that you get whatever you last worked there.

Modulation source — hold DATA

Holding the DATA key opens the modulation source, the same as a long press of DATA on the radio itself: what the rig listens to when it transmits.

The thing to know is that there are **two** settings, not one. The radio keeps a separate source for an ordinary SEND or PTT transmission and for DATA SEND, which is how a microphone on the front and a sound card on the back can both be wired up at once. Front can be Off or Microphone; rear can be Off, ACC 2, USB Audio or LAN. They cannot both be Off — the radio would key with nothing to transmit, and the dialog will not let you.

If the radio keys but nobody hears you, this is the first place to look: the source it is listening to is usually the one you are not talking into. Note that the application sets DATA SEND to rear / USB Audio whenever it transmits for you, because that is how its audio reaches the radio.

The MULT/CH knob

Like the one on the radio, this knob has no end stops — it turns for ever. Normally it steps the frequency **1 kHz** at a time, landing on round kilohertz rather than drifting off them. While the radio's menu window is open it scrolls that instead, exactly as it does on the rig.

Nothing is printed under it. The other knobs show a value there; this one has none to show, and naming the job instead would only repeat what the legend and the open window already tell you.

The RIT/XIT knob

The **RIT/XIT** knob also turns for ever, like the one on the radio. Each click moves the RIT or XIT offset one step. The offset itself is shown in the RIT / XIT readout at the top of the screen, so nothing is printed under the knob.

TF-SET

TF-SET lets you listen on your *transmit* frequency and tune it, while the receive frequency stays where it is. It is what you use before calling a station working split: switch it on, listen to where you are about to transmit, move if somebody is already there, switch it off.

It needs SPLIT. With transmit and receive on the same VFO there is no separate transmit frequency to go and listen to, and the radio refuses the command — so the key is greyed out until you are in split.

On the radio the key is *held* while you tune. Here it latches: press it on, tune, press it off. A mouse cannot hold a key and turn the dial at the same time. The lamp is red, like VFO B, because while it is lit the dial is moving your transmit frequency.

While it is on the two readouts **swap**, exactly as they do on the radio: the top one shows your transmit frequency — the one you are now listening to and the one the dial is moving — and the second shows where you were. **TF-SET** appears in the annunciator row so the swap is never silent.

On the bandscope the **R** and **T** markers merge, because the receiver really is on the transmit frequency while TF-SET is on — there is only one frequency in play. A separate marker is left behind at the spot you came from, so you can find your way back.

Only the display swaps. Anything reading the radio through this application — a logger on TCI, for instance — still sees the true VFO A and VFO B, because a swapped frequency in a log would be a wrong log.

The CAR key

CAR is the carrier level. Press it for a slider, 0 to 100. On AM it sets the carrier itself; on CW, FSK and PSK it sets how hard that mode drives the transmitter, separately from the POWER control.

The key goes out on SSB, because the radio will not accept it there — there is no carrier to set. Use POWER for the transmit level on LSB and USB.

The VFO B key

Beside the step keys is a key marked **VFO B**, with a red lamp. While it is lit, the dial, the wheel and clicks on the bandscope all move **VFO B** instead of VFO A, and the receiver does not move at all. The scope stays exactly where it is so you can keep watching the pile-up while you set your transmit frequency.

The lamp is red rather than amber on purpose: this is the one key that changes what every other tuning gesture means. If you forget it is lit you will be moving your transmit frequency while believing you are tuning the receiver.

Which VFO is transmitting

A red **TX** appears beside the frequency that the RF is actually leaving on, for as long as the key is down — beside A in simplex, beside B in split. It follows what the radio reports rather than assuming, so it is right even in unusual split arrangements.

5. The bandscope

The wide display across the top is the radio's own bandscope, with a waterfall under it.

Controls on the strip

- **ZOOM** sets the radio's span. This is a real change of span in the radio, not a stretch of the picture: at a 5 kHz span, 5 kHz is all the data that exists.
- **PAN** slides the window either side of the dial without retuning.
- **REF** sets the reference level.

- **EXP** makes the radio output a wider range than it displays.

The scope key cluster

A separate row of keys carries **RANGE** (step the span), **SHIFT**, **REF +** and **REF –**, **PAUSE** and **MHz**.

SHIFT is the radio's F4 key under its screen, and like that key it changes with the scope mode (the mode key on the bandscope's own strip shows which mode you are in):

- In **Auto Scroll** it reads **SHIFT**. A press moves the picture so the marker sits at the shift position. Hold it, or right-click it, to choose that position: the centre, or up to four grid lines either side. Towards an edge leaves more of the band in view, which helps with FT8 or when calling a DX station.
- In **Fixed** it reads **MKR·CTR**. A press moves the picture so the marker is near the middle, keeping the span.
- In **Centre** it is greyed out: the marker is always in the middle there.

REF + and **REF –** work as on the radio, 5 dB a press. **REF +** brings the trace up and the waterfall brighter: more on screen, the weak signals and the noise with them. **REF –** takes it down: less on screen, and the weak signals go first. (They do it by moving the bottom of the picture, the noise floor.) They switch automatic contrast off when you use them, because otherwise the next sweep simply recomputes the floor and puts it back — which is what made them look dead.

PAUSE freezes this window's bandscope and waterfall so you can look at something. The radio carries on receiving; only the picture stops, and sweeps that arrive while it is held are discarded rather than played back in a rush when you let go.

Both act on the picture in *this* window. The radio has its own display pause and reference level on its own screen, and those are reached from the radio — they do not change the sweeps it sends, so they could never have changed anything here.

How the picture is drawn

When strong signals hit the top

Drag the trace **downwards**. That widens the range — how many decibels fit between the bottom of the display and the top — so the tall signals get shorter while the noise floor stays exactly where it is. Drag upwards to fill the screen again.

Dragging changes the range, not the floor, and that distinction is the whole point. Moving the floor slides the entire window up the scale: the peak does come off the top, but only after the noise and every weak signal have gone off the bottom, leaving an empty rectangle with one spike in it. Use **REF +** and **REF –** when you do want to move the floor.

Because the drag leaves the floor alone, **automatic contrast can stay on** while you use it: the tracker keeps the noise at the bottom and you set the height above it.

The **DISPLAY** key holds the appearance settings: four colour palettes, automatic contrast, and manual **Floor** and **Range** sliders when you turn automatic off. **PEAK** holds the highest level each frequency has reached, fading back slowly.

All of these are remembered between sessions.

Band plans

A band plan says which part of each band is for what: CW, digital modes, phone, beacons. Choose yours under **RADIO** → **Band plan**: Australia, Canada, Ireland, the United Kingdom, the USA, or the IARU's own plan for Region 1 (Europe, Africa, the Middle East), Region 2 (the Americas) or Region 3 (Asia and the Pacific), or Off.

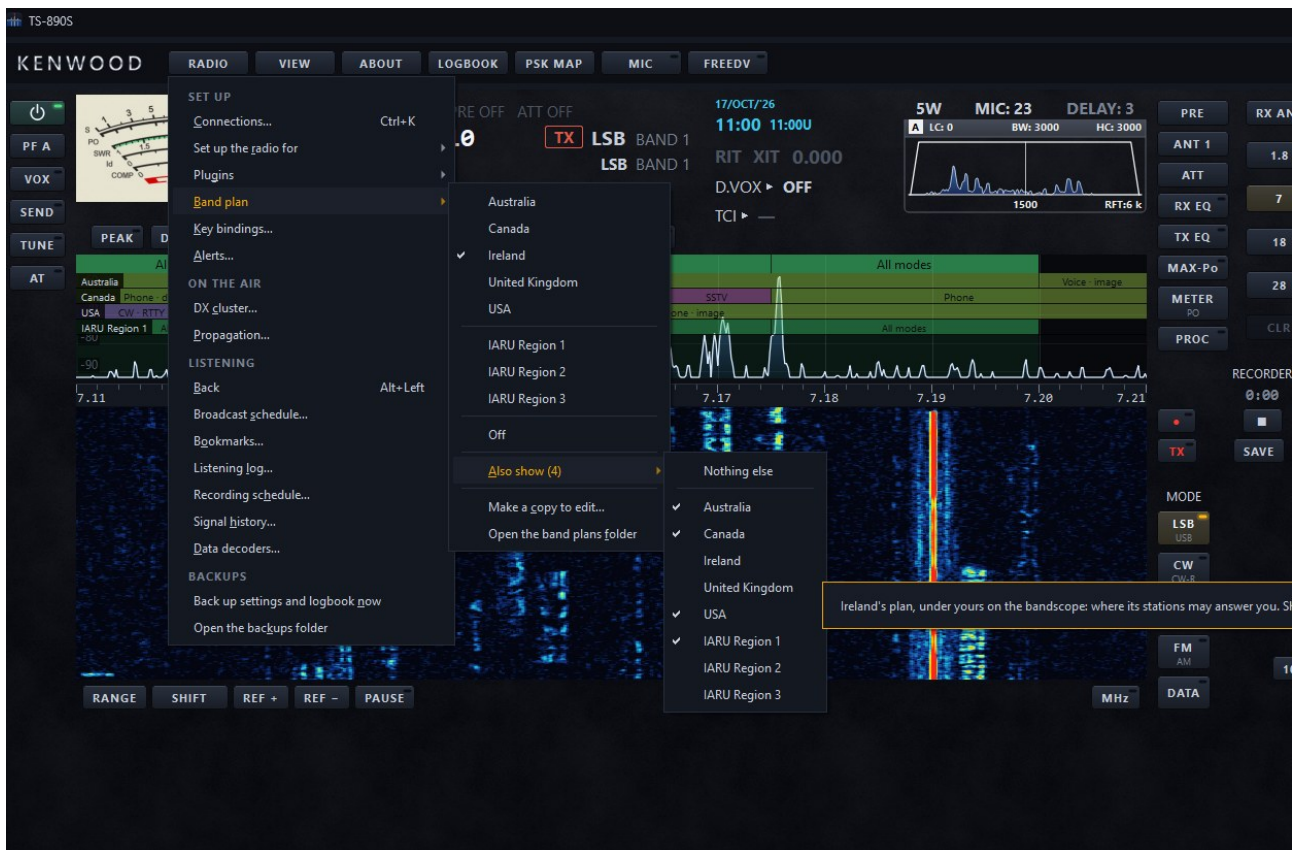
- On every band from 160 m to 6 m, and 4 m where it is allowed, coloured strips along the top of the bandscope show the parts of the band and what each is for. Rest the pointer on a strip for the details: the modes, the widest signal allowed, the power and the centres of activity.
- Anything outside the plan is tinted red.
- If what you are about to transmit would fall outside the band or the plan, or be too wide for that part of it, a short warning appears over the bandscope. The application only warns; it never stops you transmitting.

Plan	Where it comes from
Australia	The WIA's Australian Amateur Radio Band Plan, February 2026.
Canada	The RAC 0–30 MHz band plan, June 2023; 6 m from IARU Region 2.
Ireland	The RSGB 5 MHz plan and IARU Region 1 on 60 m, ComReg on 4 m, and IARU Region 1 on every other band, as the IRTS follows.
United Kingdom	The RSGB 5 MHz plan and Ofcom on 60 m, the RSGB on 4 m, and IARU Region 1 on every other band.
USA	The FCC's own rules (Part 97): RTTY and data only in the lower part of each band, phone only in the upper part. The edges shown are the Amateur Extra's; the other classes' are in each strip's details.
IARU Region 1, 2, 3	The IARU regions' HF plans (Region 1 October 2020, Region 2 September 2020, Region 3 November 2024) and their 6 m plans.

Most HF band plans are **recommendations**, not law: the IARU's, the RAC's and the WIA's. Outside one of those, the bandscope only notes it, rather than warning. Outside the band itself, or outside the FCC's segments, it warns.

Seeing other countries' plans

To call a country where its stations can answer, see its plan beside your own: **RADIO** → **Band plan** → **Also show**, and tick it. Tick up to four. Each is drawn as a thinner strip of its own under yours, in the order you ticked them, with its name at the left, and resting the pointer on one says what each part is for in that country. They are shown only: what you transmit is checked against your own plan. **Nothing else**, at the top of the same menu, takes them all away. The menu stays open while you tick, so several can be chosen in one visit.



RADIO → Band plan: the plans that come with the application, Also show with four more ticked, and Make a copy to edit and Open the band plans folder at the foot. Resting the pointer on a plan says what it is for.



40 m with Ireland's plan along the top of the bandscope and four more under it, each named at its left: Australia, Canada, the USA and IARU Region 1. Where Ireland allows all modes, the USA keeps CW, RTTY and data low in the band and phone high.

A band plan of your own

Your country is not in the list, or you want a plan as you use it? Make your own. **RADIO → Band plan → Make a copy to edit** puts a copy of the plan in use in the **band plans folder** (**Open the band plans folder** in the same menu) and opens the folder. Change the copy in any text editor — the README.txt there explains every part of the file — and save it: it is in the menu straight away, marked *yours*, and on

the bandscope if it is the plan in use.

- One file is one plan: its name, where its figures come from, and its bands, each with its edges and its parts, in kHz.
- A plan can name another as its **base**, for every band it does not list itself: a copy of Canada's needs only the bands you change.
- A plan of yours with the same id as one that comes with the application takes its place.
- If a file has a mistake in it, the log says which file and what is wrong, and the plan is left out until it is put right.



5 MHz with a band plan chosen. The green strips along the top of the bandscope are the channels and segments you may use, labelled with the modes allowed there; the red tint between them is outside the plan.

On 5 MHz the transmit filter and the receive filter are set to the plan's width, 2.7 kHz (2.8 kHz in the USA), when you arrive on the band. They are put back as they were when you leave it.

The plans come from the regulators and the national societies, each named above and in the hover text. Your licence is what counts, and not every licence class has every band: check it if in doubt.

Markers and the passband

- The shaded band behind the trace is the receiver's passband, as the radio actually has it set. Its edges can be dragged along the bottom strip of the trace to change the filter.
- White dotted lines are your registered frequency markers. Right-click anywhere on the trace to add one, or open the list from the menu.
- Coloured labels are stations WSJT-X has decoded — see section 8.

6. The audio scope

Nothing on the radio shows you your own audio. This does: the low-cut you are throwing away, the shelf the transmit filter puts on the top, the rumble under everything. On an eSSB station it is the most useful display in the application.

What the curves mean

Curve	What it is
Live trace	What the audio is doing right now.
Average (AVG)	The same thing over the last few seconds. This is the curve to judge audio by. One instant of a voice tells you nothing; the average settles into the shape your audio chain actually has.
Peak hold (PEAK)	The highest level each frequency has reached, held until you press CLR. The envelope of a whole sentence.
Min hold (in OPT)	The <i>quietest</i> level each frequency has reached — what is there all the time. Hum and birdies show up on the minimum; a voice does not.

Keys on the strip

- **SPAN** 3k to 6k — how much audio bandwidth to show.
- **RES** Fast, Medium, Fine, Ultra — the FFT length, 1024 up to 8192 points. Fine and Ultra separate close tones; Fast follows speech.
- **MASK** shades everything outside a target bandwidth, so audio straying past it cannot be missed. 2.8k is a communications channel; 3.5k and 4k are what most eSSB operators run.
- **WF** and **WAVE** show the waterfall and the waveform strip.
- **CLR** resets the peak hold, the average and the history.

Measuring (the MEAS key)

Press **MEAS** and a readout appears under the scale.

- **Click a peak** and it becomes the fundamental. Markers appear at its harmonics (2f, 3f and so on) and the readout gives **THD**, **THD+N** and **S/N**.
- **Shift-drag** across the trace to measure the power in that span.
- **Right-click** to place a marker (up to eight) or to set the fundamental.
- The five strongest peaks are listed with how far each stands above the noise floor.

The three figures mean different things and are worth keeping straight: **THD** is the harmonics alone; **THD+N** is everything except the fundamental — harmonics, hum and noise together, so always the larger number; **S/N** is the fundamental over what is left once the fundamental and its harmonics are taken out.

Measurement starts at 20 Hz, not 100, because eSSB transmitters run from about 40 Hz up. A DC blocker ahead of the analyser keeps the sound card's own offset from being mistaken for the bottom of your audio.

Comparing before and after (the HOLD key)

This is how you tell whether a change to your audio was an improvement, instead of arguing from memory.

- **Press HOLD** to capture the current average into the next free slot, A to D.
- **Press and hold HOLD** for the list: show or hide each capture on the trace, clear one, save one to a file, or load one back.
- **Difference from this** subtracts a capture from the live curve. The display switches to a ± 40 dB scale with a line through the middle: **flat on that line means identical**. Change something on the rig and you can see exactly what it did, and where.

Captures are stored against frequency rather than against the picture, so changing the span or resolution does not destroy them, and a file saved at one setting reads back correctly at another.

Options (the OPT key)

- **FFT window** — Hann, Hamming, Blackman or Blackman-Harris. Not a quality setting: it trades how close two tones can be and still separate against how much a strong one leaks over a weak neighbour. Blackman-Harris is the default and is right for almost everything.
- **Smoothing** — off, or a third, sixth or twelfth of an octave. Smooths the displayed curve the way the ear hears, without touching the measurements.
- **Min hold** and **Linear amplitude**.
- **Save the picture** (PNG) and **Save the data** (CSV). The CSV has a column per curve on one frequency axis, with the settings in the header.
- **Switch the rig's TX monitor on**.

Watching your transmit audio

With the radio's TX monitor switched on and routed to the rear connectors (menu 7-10), your transmitted audio comes back down the USB lead and the scope shows it. A tag at the left of the readout says **RX** or **TX**, in red while you are transmitting.

Receive and transmit are kept completely separate: two averages, two peak holds, two minimum holds. Your transmit profile builds up across overs instead of being diluted by band noise in between.

If you key up and the trace stays empty, the tag will tell you: the monitor is off or is not routed to the rear connectors.

The green upright lines are the radio's own filter cuts — your **transmit** filter while transmitting, the receive filter otherwise. Everything outside them is work your microphone did that the radio is about to throw away.

NR4 — noise reduction in the computer

The **NR4** key on the receiver cluster is not a radio control. Every other key there sends a command and waits for the rig to answer; this one reduces noise *here*, on the audio already coming down the USB port. It stacks with the radio's own NR rather than replacing it, so you can run both. Hold the key to adjust it.

It changes what you **hear**. The audio scope and the recorder go on seeing what the radio actually sent — the scope is a measuring instrument, and a noise reducer in front of it would quietly falsify every reading it gives. That also happens to be the only honest way to judge whether NR4 is helping: watch the untouched scope while you listen to the cleaned-up audio.

NR4 costs about 32 ms of delay, which the dialog shows. That is the price of the frame it has to collect before it can work on one; no spectral denoiser is free of it.

In the dialog, **Reduction** is the one to set first — past about 15 dB, speech starts to burble. **Whitening** fills the holes with a flat hiss, which the ear minds far less than musical noise. Leave **Tonal** at zero for CW and PSK: it reduces steady tones, and it cannot tell a CW note from a heterodyne.



The NR4 dialog, opened by holding the NR4 key. Each slider carries its own explanation underneath it.

Also feed the decoders is off by default. It can help CW and RTTY in noise, but PSK31 carries its data in the phase and a denoiser that rebuilds the spectrum can disturb it. Try it; turn it off again if decoding gets worse.

What NR4 is: the key is named for what the SDR world calls it, but the algorithm is not Warren Pratt's. Dr Pratt (NR0V) wrote WDSP, and the two noise reducers he wrote for it are the ones called NR and NR2. NR3 and NR4 were added to a WDSP fork later by Ram, VU2JXN, and each wraps an existing library — NR3 is RNNoise, NR4 is libspecbleach by Luciano Dato. This application calls the same libspecbleach, so the reduction is the same reduction.

7. CW, RTTY and PSK31

The application decodes all three and can send all three. The decoded text appears in the lower half of the waterfall, with a line underneath to type in.

Getting it on screen

Put the radio in CW, FSK or PSK, or in LSB-D, USB-D, LSB or USB, and press **DECODE** in the column beside the tuning knob. The pane opens under the bandscope.

Which modem is running

In CW, FSK and PSK the radio itself says which it is, and the pane follows. In LSB-D, USB-D, LSB and USB it cannot, because the radio has no idea what is in the audio. There a small key on the status line lets you choose **RTTY** or **PSK31**, and remembers.

Reading CW

In CW the copy appears as it is read, about one character behind the sender. The decoder works out the speed by itself, from about 8 to 45 wpm, and follows it as it changes, so it copies hand-sent CW with uneven spacing as well as a keyer. When there is only noise, it prints nothing.

You do not have to tune a station in exactly. The decoder finds the station's own tone, up to 100 Hz either side of the radio's CW pitch, and listens there, following it if it drifts. (CW T. still puts the radio itself on the station, which helps the radio's filters too.)

It reads whole words, not just letters. When a word is finished it checks it, and puts it right if it needs to:

- two words sent with no gap between them are split: *TUEC6AAE* becomes *TU EC6AAE*;
- a callsign sent with gaps in it is joined: *EI5 GJB* becomes *EI5GJB*;
- a word broken in two is joined: *NA ME* becomes *NAME*.

So the last word may change a moment after it appears: that is the decoder correcting it.

To do this it knows the abbreviations and Q-codes used in CW, common first names, and real callsigns. The callsigns come from the Super Check Partial list, which the application downloads and keeps up to date by itself (see “Keeping up to date” in section 1). A call on that list is the most trusted reading of all.



CW on 40 m, the copy coloured as it is read. CQ, DX, DE, TU and the other CW words are blue; the callsigns are orange. Words the decoder does not recognise stay green.

Words the decoder recognises are coloured, so they stand out from the rest of the copy:

Colour	What it means
Red, bold	A callsign on the Super Check Partial list: a real call, seen on the air.
Orange	Something with the shape of a callsign that is not on the list — a new call, or a call misread.
Blue	A CW abbreviation, Q-code or signal report: CQ, DE, TU, QTH, 5NN...
White	A first name.
Grey	A letter the decoder is unsure of: another reading, nearly as likely, makes it a different letter. Worth a second look.
Green	Everything else.

Double-click any word in the copy to use it — a callsign goes into the Call box, ready for the macros and the log (see “Macros” below, and section 11).

Who is on the frequency. When the station you are listening to gives its callsign — after DE, CQ, TEST or TU, or sent twice in a row — the call is written on the bandscope at that frequency, in the same colours as the DX cluster's spots. The label stays for 15 minutes, so as you tune across the band the bandscope fills in with who is where.

- A call on the Super Check Partial list is labelled straight away. One that is not on the list is labelled once it has been heard twice, so a single misreading never puts a wrong call on the bandscope.
- If another station is heard on the same frequency, its call replaces the old one. Your own callsign is never labelled.
- To turn the labels off, press **LABELS** on the decode pane's status line, beside the CW key, so that its lamp goes out. Press it again to bring them back. The choice is remembered.

CW auto-tune — CW T.

CW T., in the column beside the tuning knob, starts the radio's CW auto-tune, which moves the radio onto the exact frequency of the station you are listening to. The key stays lit while the radio is tuning, and **CW TUNE** flashes on the frequency display. Press the key again to stop it.

FINE, in the same column, tunes in 1 Hz steps (see “Step size” in section 4).

Tones and shift

You do not set them here. The decoders read the radio's own settings: the RTTY mark tone and shift (menus 2-08 and 2-06) and the PSK tone (menu 2-12). Change them on the rig and the decoder follows within a few seconds.

Which way round mark and space are follows the mode, so you do not have to think about it. FSK, FSK-R, LSB-D and USB-D are all allowed for, and copy a normal station without any setting.

Tuning RTTY

An RTTY signal is two tones, mark and space, a shift apart — not one frequency. In RTTY the bandscope shows both: an amber **M** and a cyan **S** at the foot of the trace, at the RF frequencies where the decoder is listening. Tune until the station's two peaks sit on them. In FSK the mark is the dial itself,

so **M** sits under the R marker and **S** a shift below it; in LSB-D both sit below the dial by their audio tones, and in USB-D above it.

In RTTY the decode pane grows a row of its own. On the left is the **tuning indicator**: the audio around the two tones, with dim dashed lines where the radio's settings put mark and space and bright lines where the decoder is listening. A station in tune shows its two humps under the bright lines.

- **BAUD** steps through 45.45, 50, 75 and 100 baud. Amateur RTTY is almost always 45.45; it is also the speed this application sends at.
- **AFC** lets the decoder find the station's tones for itself, up to 150 Hz either side, and follow them — the bright lines move onto the humps and the corner says by how much. What you send follows them too.
- **SYNC** lights once the tones are 5 Hz or more from the radio's own — moved by you or taken by the AFC. It retunes the radio by that amount, so the station sits exactly on the radio's own mark and space, and puts the tones back there.
- **REV** swaps mark and space. You will rarely need it: try it when the decoder says it is locked on but the text is all nonsense. That station is sending upside down. The choice is remembered, so put it back afterwards.

Moving the tones without moving the radio

You do not have to retune to work a station. **Drag the M or S tag** at the foot of the bandscope, or **click in the tuning indicator**, and the pair moves there together, a shift apart; the dial and its R marker stay where they are. The AFC then finds the station from the new place, and the indicator's corner says how far the pair has been moved.

This is the whole job: the decoder listens on the moved tones and SEND transmits on them, so a reply goes out exactly where the M and S tags are, in every mode. The pair cannot be moved outside the receive filter, because the radio would not pass the tones there — in either direction.

In **FSK** the radio's narrow RTTY filter is centred on its own tones, so a station far from them is weaker. Press **SYNC** to bring the radio onto the station. Changing mode puts the tones back on the radio's own.

While you are sending, the M and S tags stay where they are: the over goes out where it started. Move them once it has finished.

Tuning PSK31

PSK31 is one narrow signal, so the bandscope shows one amber tag, **P**, at the foot of the trace. It is where the decoder is listening and where SEND transmits. In the radio's PSK mode it sits on the dial, under the R marker. In the other modes it starts at the radio's PSK tone (menu 2-12) inside the passband.

In LSB, USB, LSB-D and USB-D the P, M and S tags show only while **DECODE** is on, for the modem chosen on the pane. They stay out of the way while you work SSB or FT8. In FSK and PSK they show as soon as the radio is in the mode.

Drag the P onto a station's trace to copy it. Your reply goes out on the P too, so it lands on the station you are answering. The dial does not move. Changing mode puts the P back on the radio's own tone. As with RTTY, the P stays put while you are sending.

Tuning to another station — a band key, a click on the scope, a typed frequency — starts the AFC over, because what it had found belonged to the station that was there.

Sending

Mode	How it goes out
CW	Through the radio's own keyer, at the speed set by the KEY knob. Type in the line and press Enter. STOP clears whatever is still queued.
RTTY and PSK31	The application makes the tones and plays them into the radio's USB audio input, then keys the transmitter. You need a transmit audio device chosen in Connections. The macro keys send the same way.

RTTY and PSK31 can be sent from any of the modes they decode in. You type and press Enter, or press a macro key, and the application does the rest:

Radio in	What happens when you send
LSB-D, USB-D	It goes straight out.
FSK, FSK-R, PSK, PSK-R, LSB, USB	The radio changes to LSB-D or USB-D for the over, with the dial moved so the signal goes out on exactly the same frequency. When the over ends, the mode and dial go back exactly as they were. The log says so each time.

Why the change: in FSK and PSK the radio makes its own tones and ignores audio from a computer, and in plain LSB and USB the speech processor and the TX EQ would be in the way. The other station hears the same signal either way.

Because the dial has to move for the over, sending from FSK, PSK, LSB or USB is refused with LOCK on, on a memory channel, and in split. The log says why. In LSB-D and USB-D none of this applies.

Check the power on your first over: the radio may keep a different power setting in the DATA modes than in FSK or PSK.

RTTY goes out on the tones the decoder is listening on, AFC included, so a reply lands on the station you are answering even before SYNC.

Macros — F1 to F8

Above the typing line is a row of eight macro keys, the same in CW, RTTY and PSK31: CQ, answer, report, 73, QRZ?, AGN and TU to start with, and a spare. **Click** one to send it. **Shift-click** puts it in the typing line instead, to change before you press Enter. While you are typing, **F1** to **F8** do the same.

Beside the keys are two boxes for the station you are working: **Call** and **RST**. **Double-click a callsign** in the decoded text: it lights up, and a menu asks what it is — choose **Use as the DX callsign** and it goes into Call. Section 11 has the whole menu, and a QSO from the copy to the log, with a picture of it. **EDIT** opens your own station — call, name, QTH, grid — and the eight messages, each with a short label for its key.

Field	Filled in with
{MYCALL} {MYNAME} {MYQTH} {MYGRID}	Your station, from EDIT
{CALL}	The Call box
{RST}	The RST box — 599 unless you change it



RTTY on 40 m in LSB-D, locked on at 19 dB S/N. Under the copy are the tuning indicator with its M and S lines, 45 Bd, AFC and SYNC, then the Call and RST boxes, the macro keys and the typing line. On the right, EDIT has opened your station details and the eight messages.

A macro that needs a field with nothing in it is not sent — the status line says which field, so “DE K” never goes on the air. Each mode still sends only what it can: RTTY in capitals, CW the characters the radio's keyer knows, and a line break is a new line in RTTY and PSK31 and a space in CW.

8. FT8, and knowing what is new

The application does not decode FT8. WSJT-X already does it well and is already set up, and a second decoder on the same audio would only disagree at the edges. Instead it reads what WSJT-X has decoded and puts each station on the bandscope at the frequency it was actually heard on.

Colours on the scope

Colour	Meaning
Amber	A DXCC entity you have never worked.
Cyan	An entity you have worked, but not on this band.
Green	Worked before.
Dim	The callsign could not be placed.

An **L** after a callsign means the station uses Logbook of the World. The entity name is shown beside the alerts.

Setting it up

RADIO → **Alerts** has a master switch, a switch for each kind of alert, and the three sources it reads: a country file, your log, and the LoTW user list. It finds all three automatically if you use Log4OM;

otherwise point it at a country file and at your log — an ADIF export from any logging program will do. Once this application's own logbook (section 11) holds your QSOs, it is the log the alerts read, and every QSO you save counts at once.

The same colours are used in the DX cluster (section 14), so a spot for a new country or a new band stands out there too.

Calls to watch for

To be told when a particular station turns up — a friend, a station you need, a DXpedition — type its call under **Calls to watch for** in **RADIO** → **Alerts**. Put spaces between calls. A * stands for any letters, so VP8* is every call starting VP8. A call also matches with /P, /M or a prefix added.

You are told the moment a watched call is:

- spotted on the DX cluster, or heard by a Reverse Beacon Network skimmer;
- decoded in FT8;
- heard by the CW decoder giving its call.

The alert goes in the log and the status bar, with a sound and a small window if **Play a sound** and **Show a window** are ticked. For a cluster spot, the window has a **Tune** key that takes the radio straight there. Each call is alerted once per band in half an hour, so a busy station does not keep interrupting you.

Setting the rig up for FT8

RADIO → **Set up the radio for** → **FT8** does the whole job in one press: data mode, filters wide, AGC slow, noise reduction and processor off, equalisers flat, transmit filter opened up, and the power set where you want it. Every row shows what the radio has *now* beside what it will be changed to, each row can be unticked, and there is a **Put it back** button that undoes exactly what it did.

9. Your microphone, and FreeDV digital voice

You can talk on the air through the computer: a headset or desk microphone plugged into the PC goes to the radio over its USB audio. The same path carries FreeDV, the digital voice mode, so once the microphone works, FreeDV needs nothing more set up.

Talking through the computer

Open **RADIO** → **Connections**. On the **Microphone** page, tick **Mic in** and pick your microphone. Talk, and watch **Level**: aim for peaks around -12 dB. If a quiet headset never gets there, or a desk microphone goes past it, move **Trim**. How loud the radio is driven is still set with **Drive out**, the same as for everything else the application transmits.

Then hold the **MIC** key on the top bar, or hold **F12**, and talk. The application sets the radio to take its audio from USB and puts it into transmit. Let go and it goes back to receive as soon as your last words have reached the radio. Tick **MIC key latches** if you would rather click once to talk and again to stop; F12 is always hold-to-talk.

The application adds no equaliser or compressor of its own. Shape your sound with the radio's transmit equaliser, or with plugins of your own choosing (section 10), and check it on the audio scope (section 6). For safety, the microphone never transmits for more than three minutes at a time.

What FreeDV is

FreeDV turns your voice into data and sends it as a quiet, narrow signal about 1.5 kHz wide. On the other end the voice comes out without the hiss and fading of SSB, or not at all, much like a digital radio station. It is free, open, and used all over the world; the FreeDV application on a computer is what most stations run, and this application talks to it directly.

Mode	What it is for
RADE	FreeDV's main mode now, and where most stations are. It uses a machine-learning speech coder and sounds the most natural of them all. Start here.
700D	Copies very weak signals, down to about 0 dB signal-to-noise.
700E	Copes best with fast fading; needs a couple of dB more signal.
1600	The oldest mode. Needs a good signal.

Both stations have to be in the same mode, and on the same sideband. FreeDV's own convention is USB on every band and most stations follow it, but on 40 and 80 metres you will also find FreeDV on LSB, the way SSB is worked there. Stations are usually around 14.236 MHz and 7.177 MHz; FreeDV Reporter, below, shows where they are right now.

Setting the radio up

RADIO → **Set up the radio for** → **FreeDV** does it in one press, the same way the FT8 setup does: it reads each setting from the radio first, shows what it has now beside what it will be changed to, lets you untick any row, and **Put it back** undoes exactly what it did.

Setting	For FreeDV
---------	------------

Mode	The DATA side of the sideband you are on: USB-D , or LSB-D if the radio is in LSB. The DATA modes keep their own filter settings, so nothing here touches your SSB phone setup.
Receive filter	300 to 2700 Hz. Every FreeDV mode sits between about 750 and 2250 Hz; much narrower than this starts to clip the outer carriers of RADE and 700E, and wider only lets in more noise.
Noise reduction, notch, beat cancel	Off. The modem wants the band exactly as it is. Leave NR4 off too.
Speech processor	Off. It squeezes a modem signal out of shape.
Equalisers	Switched off, not changed. Your EQ settings are kept, and Put it back switches them on again.
Transmit filter (DATA)	200 to 2700 Hz, menus 6-08 and 6-09.
Power	Your choice. FreeDV keeps the transmitter working the whole time you talk; a third to a half of your SSB power is usual.

How wide each mode is, for reference. All of them are centred on about 1500 Hz in the audio, which is where the green DV mark sits.

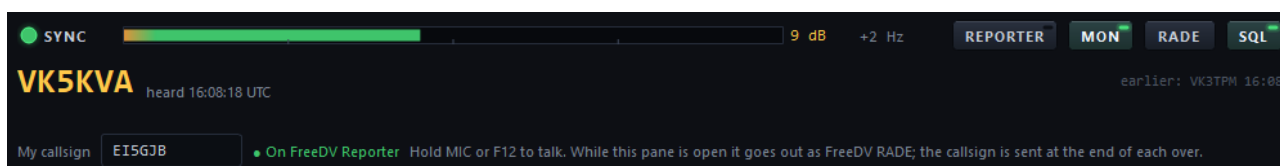
Mode	Roughly occupies
RADE, 700E	1.5 kHz: about 750 to 2250 Hz
1600	1.25 kHz: about 900 to 2150 Hz
700D	1 kHz: about 1000 to 2000 Hz

Getting ready

- Put the radio in a sideband mode: USB-D usually, or LSB-D where the stations you want are on LSB. The FreeDV pane tells you if the radio is in anything else.
- In Connections, tick **Audio in** (the radio's receive audio) and **Listen** (the decoded voice plays through it). **Mic in** is only needed for transmitting.

The FreeDV pane

Press **FREEDV** on the top bar. The pane opens under the waterfall, where the CW and RTTY text would be, and a green **DV** mark appears on the bandscope where a FreeDV signal should sit.



The FreeDV pane in RADE: in sync on a signal 9 dB above the noise, VK5KVA heard a moment ago, VK3TPM before that.

Part	What it tells you
SYNC	Lit green while the modem has locked on to a FreeDV signal.

The meter	Signal-to-noise, 0 to 20 dB. The shaded part at the left is where the chosen mode starts to struggle.
+2 Hz	How far the signal is from where it should be. FreeDV follows small offsets by itself.
REPORTER	Opens FreeDV Reporter, and closes it again. Lit while its window is open.
MON	Lit: while you transmit you hear your own signal decoded, a moment late, as another station hears you. Needs the radio's transmit monitor on USB (menu 7-10).
Mode key	Steps through RADE, 700D, 700E and 1600.
SQL	Squelch. On: silence until there is FreeDV to decode. Off: you hear the band as it is, which helps when tuning.
The big callsign	The station you are hearing, when its callsign comes through, with the time. Earlier stations are listed on the right.
My callsign	What your station sends. It starts as the callsign set for the macros.
On FreeDV Reporter	Shown in green beside your callsign while your station is on the public FreeDV Reporter list.

Listening

Tune so a FreeDV signal sits on the green DV mark. Within a second or so SYNC lights, the meter moves, and you hear the other station. In RADE the callsign arrives when the other station stops talking, because RADE sends it once, at the end of each over; in the other modes it arrives while they talk.

Transmitting

With the FreeDV pane open, the MIC key and F12 send your voice as FreeDV, in the mode shown, with your callsign. A red **TX** badge shows in the pane while you transmit. In RADE, when you let go the radio stays in transmit for about a third of a second more, to send your callsign; that is expected.

A FreeDV signal keeps the transmitter working all the time you talk, unlike SSB speech, so run less power than you would for SSB and set **Drive out** so that the ALC barely moves. Try it into a dummy load first.

FreeDV can only be switched on or off while you are receiving.

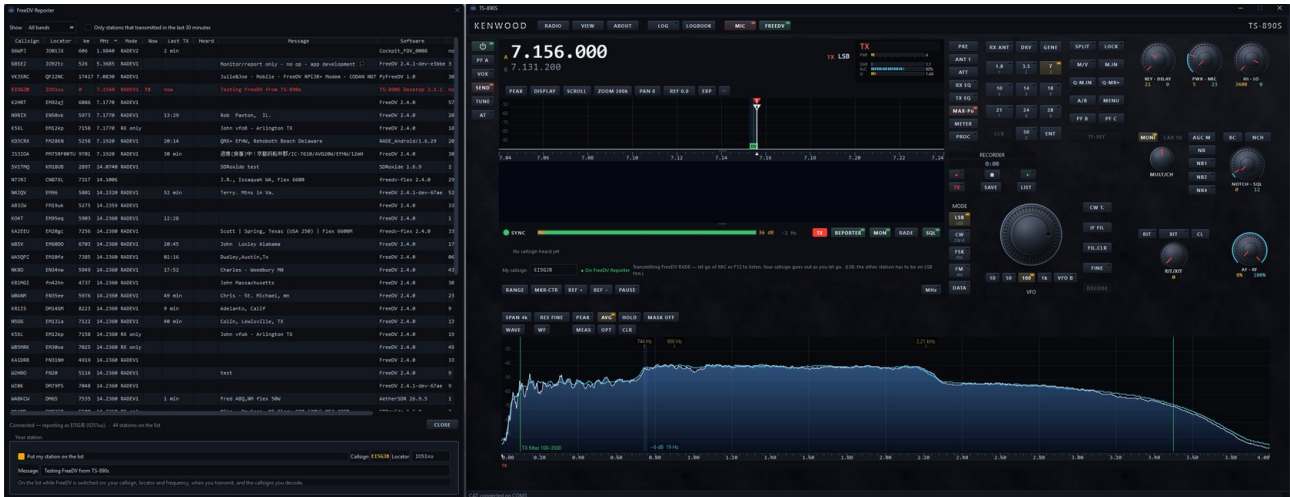
While FreeDV is on, the recorder keeps what you hear: the decoded voice, not the modem sound. With MON lit and the transmit monitor on USB, a recording of one of your own overs is your voice as a FreeDV receiver decodes it, which is the way to check how you sound.

FreeDV Reporter

FreeDV Reporter is the live list of FreeDV stations on the air, at qso.freedv.org. Press **REPORTER** in the FreeDV pane to see it: callsign, locator, distance from you, frequency, mode, who is transmitting now (shown in red), when each last transmitted, who they have heard and how well, and their message. **Show** narrows it to one band or to the radio's band.

Double-click a station to tune the radio to it. The sideband you are on is kept; only if the radio is in something else, such as CW or AM, is it put in USB-D.

To put your own station on the list, tick **Put my station on the list** and fill in your locator (four or six characters, such as IO51 or IO51ab) and, if you like, a short message. From then on, while FreeDV is switched on, the list shows your callsign, locator and frequency, when you transmit, and the callsigns you decode, the same as the FreeDV application reports them. With the box unticked nothing about your station is sent; the list is only read.



FreeDV Reporter beside the front panel. This station, EI5GJB, is on the list and transmitting in RADE on 7.156 MHz: its line is red, with “TX” and “now”, and the FreeDV pane shows the red TX badge and “On FreeDV Reporter” beside the callsign.

Along the bottom of the window, **Your station** holds the tick box, your locator and your message; the line above it says whether the list is connected and how many stations are on it. **Only stations that transmitted in the last 30 minutes** hides the ones that are only listening or have gone quiet. Click a column heading to sort by it.

10. Plugins: shaping what you send and what you hear

The application can run VST 3 plugins: the same equalisers, compressors, de-essers and noise reducers a recording program uses. There are two chains of them, each with its own window.

Chain	What goes through it	What does not
Microphone	Your voice from Mic in, before it goes to the radio, and before FreeDV when FreeDV is on. It runs all the time, not only while you transmit, so a compressor has already settled on your voice when you press MIC.	—
Listen	The radio's audio you hear through Listen on this computer, and FreeDV's decoded speech.	The decoders, the audio scope, recordings and TCI. They get the radio's audio exactly as it arrives.



Two Listen plugins, FabFilter Pro-MB and Pro-Q 3, working on the receive audio with their own windows open. In Connections, on the left, Listen plugins shows “2 of 2 on” and the microphone's Plugins “1 of 1 on”.

Opening a chain

In **RADIO** → **Connections**, press **Plugins...** on the Microphone page for the microphone chain, or on the **Listen plugins** line of the Audio page for the Listen chain. The text beside each button says how many plugins are in the chain and how many are on. The same windows are under **RADIO** → **Plugins** → **Microphone** and **RADIO** → **Plugins** → **Listen**, where a green lamp shows a chain with plugins on.

Adding a plugin

Press **ADD...**. The list shows every VST 3 plugin installed in the usual place, C:\Program Files\Common Files\VST3 on Windows. **Double-click** one to add it, or select it and press **ADD**. A file that holds more than one effect opens to show them all: pick the one you want. **Find by name** narrows the list, and **OTHER...** adds a plugin kept somewhere else. Instruments are not offered.



Adding a plugin to the microphone chain. The list is everything installed on this computer; the Microphone plugins window beside it is still empty.

The first time a plugin is looked at, it can take a while to answer, because some check their licence first; the list says “Looking inside...” meanwhile. Loading one into the chain can take a while too; the window says “Loading...” until it is ready. Either way the rest of the application carries on: the front panel, the radio, transmit and receive are not held up.

The plugins window

Part	What it does
On	Ticked: the plugin works on the audio. Unticked: it is skipped, and keeps its settings.
In / Out	The level going into the plugin and coming out of it. An Out level in amber is more than 10 dB below In: that plugin is cutting the audio.
Channels	mono , or stereo , averaged for a plugin that only works in stereo. That kind is given the same audio on both sides, and its two outputs are averaged.
Delay	How long the plugin holds the audio back, for example to look ahead. The line under the list adds it all up.
ADD... / REMOVE	Add a plugin at the end of the chain; take out the selected one.
UP / DOWN	Move the selected plugin. The audio goes through the list from top to bottom.
OPEN	Opens the selected plugin's own window, to set it up. Double-clicking a row does the same.
ALL OFF	Lit: every plugin is skipped at once, to hear the difference they make. Press it again to put them back.
CLOSE	Closes this window. The plugins keep working.

The line under the list says how many plugins there are, how much they delay the audio, and whether audio is going through now. The Listen chain only has audio while **Listen** is ticked in Connections.

Settings are kept

Everything you set in a plugin's own window is kept, along with the order of the chain and what is on or off, and it all comes back the next time the application starts. Settings are saved while a plugin's window is open, when it closes, and when the application closes.

Delay

Each plugin adds its own delay, shown in the Delay column, and passing the audio to the plugins and back adds about 10 to 20 ms more. With no plugins, or ALL OFF lit, nothing is added at all. A delay on the microphone makes no difference to the station you are working, but a long one on the Listen chain is noticeable; some noise reducers hold the audio back by 100 ms or more.

FreeDV's speech coder is built for natural speech. Keep the microphone processing modest while you use FreeDV; heavy compression or a steep equaliser in front of it will not help it.

When a plugin misbehaves

The plugins do not run inside the application. Each chain runs in a program of its own that the application starts in the background, so a plugin that is slow, stops responding or crashes cannot take the front panel with it, or leave the radio stuck in transmit.

- If a plugin **crashes**, it is taken out of the chain and the others start again. The plugins window and the log say which plugin it was. Your audio goes on untouched meanwhile.
- If the plugins **stop responding**, the audio carries on without them within half a second. After a few seconds they are stopped and started again the same way.
- If they **keep failing**, three times in a minute, they are stopped and your audio goes through untouched until you open the plugins window and try again.

Because a plugin's own window belongs to that background program, it shows as a separate entry on the taskbar.

If a plugin puts out no sound

A plugin whose trial has run out, or that is not licensed on this computer, often mutes the audio completely instead of saying so. The plugins window notices audio going in and nothing coming out, and warns you. Open that plugin's window: it usually says what it wants.

11. Logging QSOs

The application keeps a full logbook of its own, and it can be your main log. It keeps every ADIF field a QSO carries, works out each station's country, zones and continent, shows your statistics and a map of everything you have worked, and sends your QSOs to QRZ.com and Logbook of the World. It also stays in step with your logging program in both directions, so you can go on using Log4OM, or any other logger, beside it.

The screenshot displays the Logbook application interface. At the top, it shows the total number of QSOs (7,682), DXCC entities worked (189), and confirmed QSOs (136). A search bar and several action buttons (NEW QSO, IMPORT, EXPORT, CABRILLO, CALENDAR, LOGGER LINK, QSL SERVICES) are present. Below this is a filter bar with tabs for BAND, MODE, PHONE, DATA, QSL, CONFIRMED, NOT CONFIRMED, LOTW, PAPER, EQSL, QRZ, WHEN, TODAY, 7 DAYS, 30 DAYS, THIS YEAR, CONTEST, and All QSOs. The main table lists QSOs with columns: DATE, UTC, CALL, BAND, MHZ, MODE, SENT, RCVD, NAME, COUNTRY, GRID, QSL, and COMMENT. The selected QSO is ON6ID, Hugo De Clercq, Belgium - EU, 7.1800 MHz 40m - SSB - sent 59, rcvd 59 - 100 W. A sidebar on the right shows the selected QSO details and a list of worked QSOs before.

The Logbook window holding 7,682 QSOs read in from Log4OM: 189 DXCC entities worked and 136 confirmed. Each filter key along the top shows how many QSOs it holds. ON6ID is selected, and the card on the right shows their name, country and zones, the QSO itself, where it stands with each QSL service, and every earlier QSO with them.

Logging a QSO

Ctrl+L logs a QSO from anywhere in the application. So do **NEW QSO** in the Logbook window and the **LOG** key on the macro row of the decode pane. Ctrl+L and LOG work in two presses:

- **The first press** opens a QSO in the Log QSO window.
- **The second press** saves it and closes the window. **SAVE** in the window, or Enter in any of its fields, does the same.

So a QSO is opened when it starts and saved when it ends, and both the start time and the end time are right without anybody typing them.

The Log QSO window

The window has three parts: a strip across the top with what the application already knows, the **QSO** card on the left for what you fill in, and the **Station** card on the right, which tells you about the station you are working.

Log QSO

FREQUENCY

3.730.000

BAND

80m

MODE

SSB

STARTED

00:06:10

UTC NOW

00:06:43

THEIR SIGNAL

S9+3

S-METER

QSO

CONTEST

No contest

CALENDAR

CALL

EI5GJB

REPORT

SENT

59

RCVD

NAME

Leslie Mccarthy

QTH

Cork

LOCATOR

NOTE

A note for the log

STATION

QRZ

NO PHOTO

EI5GJB

Leslie Mccarthy, Cork

Ireland · EU

LoTW QRZ

CQ 14 · ITU 27

QRZ.com sends locators, map positions and photos only to XML Data subscribers.

WORKED BEFORE

3 QSOs in the log.

Date	Band	Mode	QSL
2010-12-20	10m	SSB	
2008-06-21	20m	SSB	
2008-06-21	40m	SSB	

QRZ.com: Leslie Mccarthy, Cork, Ireland

DISCARD

SAVE

A QSO on 80 m SSB. Across the top are the frequency, band, mode, start time and their signal, S9+3. In the QSO card, the name and QTH came from QRZ.com and are outlined to show it. The Station card gives the country, zones and badges, says why there is no photo (a free QRZ.com account), and lists the three earlier QSOs with this station.

Nothing on the strip across the top needs typing:

On the strip	What it is
Frequency	Where you are transmitting: the dial, or VFO B when you work split, since that is where the other station called you. If you change frequency while the QSO is open, it follows the radio.
Band	Worked out from the frequency.
Mode	SSB is logged with LSB or USB as its sub-mode; CW, RTTY and PSK31 as themselves; in LSB-D and USB-D, whichever of RTTY and PSK31 the decode pane is set to.
Started	The start time: the moment the QSO was opened.
UTC now	The time now. It becomes the end time when you save.
Their signal	Their signal on the application's S-meter: the strongest reading of the last five seconds of receive, so opening the QSO just after they stop talking still catches them. Readings taken while you transmit are never counted.

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S-METER	Takes the reading again, now. In SSB the Sent report follows it, unless you have typed a report of your own.
---------	--

The QSO card:

Field	What goes in it
Contest	<i>No contest</i> for an everyday QSO. Choose a contest and the card changes to suit it — see section 12.
Call	Their callsign. In CW, RTTY and PSK31 it arrives filled in from the decode pane's Call box; in SSB, AM and FM you type it. A QSO cannot be saved without one.
Sent	The report you gave them. In CW, RTTY and PSK31 it comes from the decode pane's RST box. In SSB, AM and FM it is made from the S-meter (S7 becomes 57, and anything over S9 is 59), and it follows the meter until you type a report of your own.
Rcvd	The report they gave you.
Name, QTH, Locator	What they told you about themselves. With QRZ.com lookups switched on (section 13), these fill themselves in as you type the call. In the text modes you can double-click the word in the decoded text instead of typing it (see below).
Note	Anything else. It goes into the log as the QSO's comment.

A field that was filled in for you, from the decoded text or from QRZ.com, gets a coloured outline, so a value that arrived while you were looking elsewhere is easy to spot. If it is wrong, type over it.

The Station card fills in as soon as there is a call:

On the card	What it tells you
Photo	Their photo from QRZ.com. The QRZ key above it opens their QRZ.com page in your web browser.
Name and country	Their name and QTH, and their country and continent.
Badges	NEW COUNTRY : a DXCC entity that is not in your log. NEW BAND : an entity you have worked, but not on this band. FIRST QSO : you have never worked this callsign. LoTW and eQSL : they use Logbook of the World or eQSL, so a confirmation is likely. QRZ : QRZ.com has a page for them.
Locator and distance	Their locator, how far away they are, the bearing from you, and their CQ and ITU zones. The line under it says what the distance was measured to (see below).
Worked before	Every QSO you have had with them, newest first: the date, band and mode, and whether it is confirmed.

How the distance is measured. It is the great-circle distance from your locator to theirs, so it can only be as good as the two locators. Yours is the one set under **EDIT** on the decode pane's macro row; a six-character locator such as IO51XU is accurate to a few kilometres. Theirs comes from the best source available, and the line under the distance names it: their exact position on QRZ.com's map, the locator QRZ.com gives, the locator in an earlier QSO in your log, or one you typed into the form yourself. A

four-character locator such as IO53 is a square roughly 110 km by 220 km, so a distance measured to its middle can be well out, and the card says by how much.

QRZ.com sends photos, locators and map positions only to its XML Data subscribers. With a free account the name and country still fill in, and the card says why the rest is missing.

The keys along the bottom:

Key	What it does
DISCARD	Drops the QSO without logging it and starts a fresh one, so the window stays open, ready for the next station. To close the window without logging, use its ×.
SAVE	Logs it. The S-meter is read one last time, the end time is stamped, and the QSO goes into the logbook and on to your logger. Enter in any field, or Ctrl+L, does the same.

More is saved than the window shows: the end time, your own call and locator (from **EDIT** in the macros), your transmit power as the radio has it set, the S-meter reading (in the log's notes, as for example "S-meter S7"), and the station's country, DXCC number, zones, continent and WPX prefix, all worked out from the call.

A CW, RTTY or PSK31 QSO, from the copy to the log

In the text modes the decoded copy, the macros and the log work as one. Everything the QSO needs is either already in the copy window or in a box beside it, and the aim is that nothing has to be typed twice — or at all.



CW on 20m at 30 wpm, locked on at 23 dB S/N. LA8HGA has been double-clicked in the copy: it is lit in amber and the menu asks what it is, with Use LA8HGA as the DX callsign ready for a second click. Below the copy are the Call and RST boxes, the macro keys, EDIT and LOG, and the line to type into.

What is on the screen, from the top:

Part	What it is for
The copy	What the decoder hears, as it hears it. Double-click any word in it to use it — see the menu below.
Status line	Under the copy: in CW the speed, whether the decoder is locked on, and the signal-to-noise (30 wpm · locked · 23 dB S/N); in RTTY and PSK31 the lock and S/N. It also carries short messages — which macro was refused and why.
LABELS	In CW only: whether the stations the decoder hears giving their callsign are named on the bandscope (section 7). Lit means on.
CW / RTTY / PSK31, CLR	Which modem is running, and CLR to wipe the copy. CLR leaves the decoder alone, so it does not lose its lock.
Call	The station you are working — {CALL} in the macros, and the call the log takes. In the picture it still holds GB1US from the last QSO until LA8HGA is chosen.
RST	The report you are giving — {RST} in the macros, and Sent in the log. 599 until you change it.

F1 to F8	The macro keys, each wearing its own label. Click to send; Shift-click to put the text in the typing line first; F1 to F8 on the keyboard do the same while typing. A label is yours to choose — F8 is <i>CONT</i> here.
EDIT	Your station (call, name, QTH, locator) and the eight messages.
LOG	The same as Ctrl+L: open the QSO, then save it.
Typing line, SEND, STOP	Type and press Enter (or SEND) to transmit; STOP ends a transmission part-way.

Double-click a word in the copy and it lights up, and the menu asks what it is:

Choice	What happens
Use LA8HGA as the DX callsign	LA8HGA goes into the Call box, where every macro with <i>{CALL}</i> picks it up, and into the QSO being logged if one is open. It stays lit in the copy, so you can see whom you are working. It is the first choice and is already selected, so a second click where you double-clicked confirms it. A word that does not look like a callsign is still offered, marked <i>does not look like one</i> — the choice is yours.
Their report to me	Into the QSO as the report received (Rcvd). In CW, cut numbers are written down as figures: 5NN becomes 599.
Their name	Into the QSO's Name, written as a name — LESLIE becomes Leslie.
Their QTH	Into the QSO's QTH, the same way.
Their locator	Into the QSO's Locator, e.g. IO51.
Cancel	Nothing is used, and the highlight goes. Esc, or a click anywhere else, does the same.

The four choices under *Into the QSO being logged* open a QSO for you if none is open yet, so you can start filling it in from the copy before pressing LOG at all. The word is read out whole, slashes and all: double-clicking anywhere in EI5GJB/P gives EI5GJB/P, not EI5GJB.

So a whole QSO, as it happens in the picture:

- **LA8HGA is calling.** Double-click LA8HGA and click again: it is in Call.
- **Answer** with ANS (F2 as it comes): it goes out as *LA8HGA DE* your call twice *K*. Then RPT gives your report, name and QTH — *{RST}* becomes the 599 in the RST box. A macro that needs a field with nothing in it is not sent, and the status line says which.
- **They reply.** Double-click their report, name, QTH or locator as each comes up in the copy, and choose what it is. The first one opens the QSO with the time it started.
- **Sign off** with the 73 or TU key.
- **Press LOG.** If the QSO is not open yet, this opens it with LA8HGA, 599 and their S-meter reading already in — check it, and press LOG again (or Enter) to save. It goes into the logbook and straight on to your logger.

RTTY and PSK31 work exactly the same way, in the same pane; only the status line and the RTTY tuning row differ. In SSB there is no copy to pick from, so the call is typed into the Log QSO window instead.

The Logbook window

LOGBOOK, on the bar across the top of the main window, opens it. The line beside the title counts your QSOs, the DXCC entities you have worked and the ones confirmed. Next to it, a lamp shows the link to your logging program: green when its log was last read without trouble, amber when something needs attention, and grey when there is no link. Rest the pointer on it to see what the link has done in each direction.

Key	What it does
NEW QSO	Opens the Log QSO window, the same as Ctrl+L.
IMPORT	Reads QSOs from an ADIF file. QSOs that are already in the logbook are not added twice, and imported QSOs are not sent on to your logger, since they came from a log already.
EXPORT	Writes the QSOs shown now, with the filters as they are, to an ADIF file.
CABRILLO	Writes the contest chosen under CONTEST as a Cabrillo log, ready to send in (section 12).
DUPLICATES	Finds QSOs that are in the logbook more than once, and removes the spare copies if you say so (see <i>Finding duplicates</i> below).
CALENDAR	Opens the contest calendar (section 12).
LOGGER LINK	The link to your logging program, both ways (see <i>Your logging program</i> below).
QSL SERVICES	Your QRZ.com and LoTW logins, sending QSOs and fetching confirmations (section 13).

Finding QSOs

The rows of keys under the title are filters. Each key shows how many QSOs it holds, and the filters you choose apply to all four tabs and to EXPORT.

Filter	What it does
Find box	Type part of a call, a name, a country or a locator.
BAND	Click a band to see only that band. Ctrl+click adds another band to the ones already chosen. ALL shows every band.
MODE	CW, PHONE or DATA.
QSL	CONFIRMED or NOT CONFIRMED, or confirmed by one service: LOTW, PAPER, EQSL or QRZ.
WHEN	TODAY, the last 7 DAYS or 30 DAYS, or THIS YEAR.
CONTEST	One contest's QSOs, by contest and year: that contest's log, ready for EXPORT or CABRILLO.

CHANGED
HERE

QSOs you have edited here that your logging program does not have yet (see below).

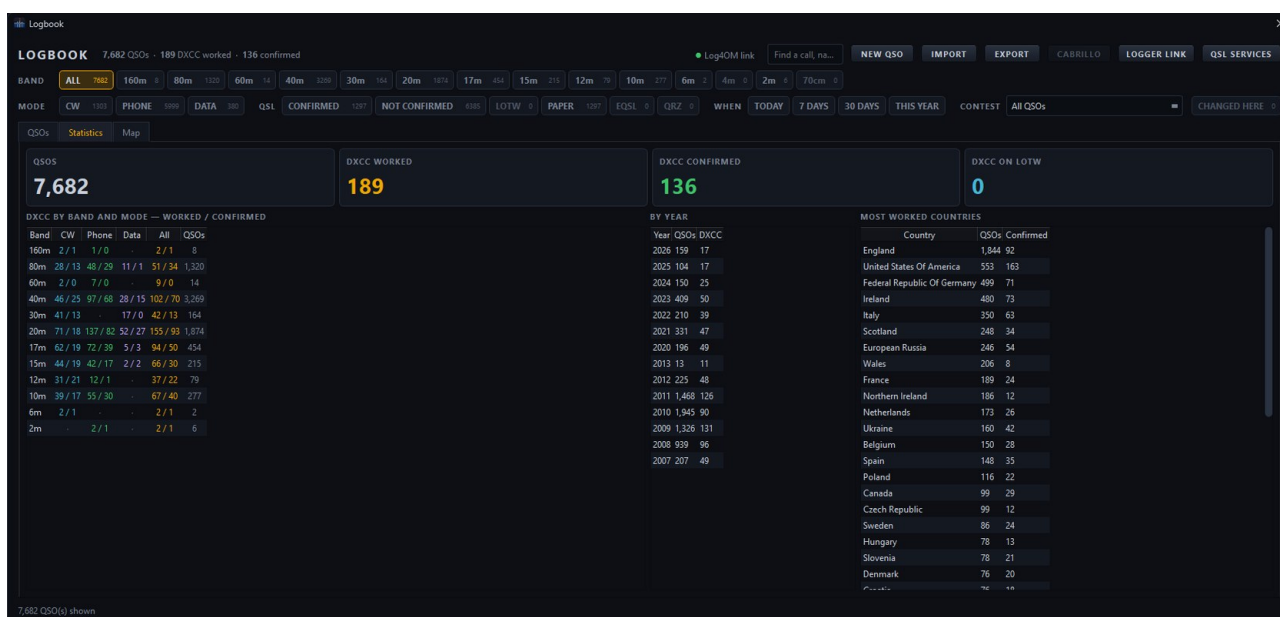
The QSOs tab

One row per QSO, newest first. Click a column heading to sort by it. The **QSL** column has four small letters, one for each way a QSO can be confirmed: **P** for a paper QSL card, **L** for LoTW, **E** for eQSL and **Q** for QRZ.com. A dim letter means nothing has happened yet, an outlined letter means the QSO has been sent, and a filled letter means it is confirmed. Rest the pointer on the letters to see which services have confirmed it. A callsign in amber is a QSO you have changed here that your logging program does not have yet.

Click a QSO and the card on the right shows it in full: the station, their locator and zones, the QSO itself with the power you used, its QSL status with each service, where it came from (logged here, read from Log4OM, or imported), and every other QSO you have had with them. Under the card:

Key	What it does
EDIT	Opens the QSO to correct it. Double-clicking a row does the same. Every field is there, including the QSL status for each service; Other fields lists every other ADIF field the QSO carries, and a double-click changes one. A QSO with the USA that has no state is given an empty STATE line there, so you can add it for WAS.
DELETE	Removes the selected QSOs from this logbook, after asking. A QSO that is also in your logging program's log stays there: delete it there as well, or it will come back here the next time that log is read.
QRZ	Opens the station's QRZ.com page in your web browser.

The Statistics tab



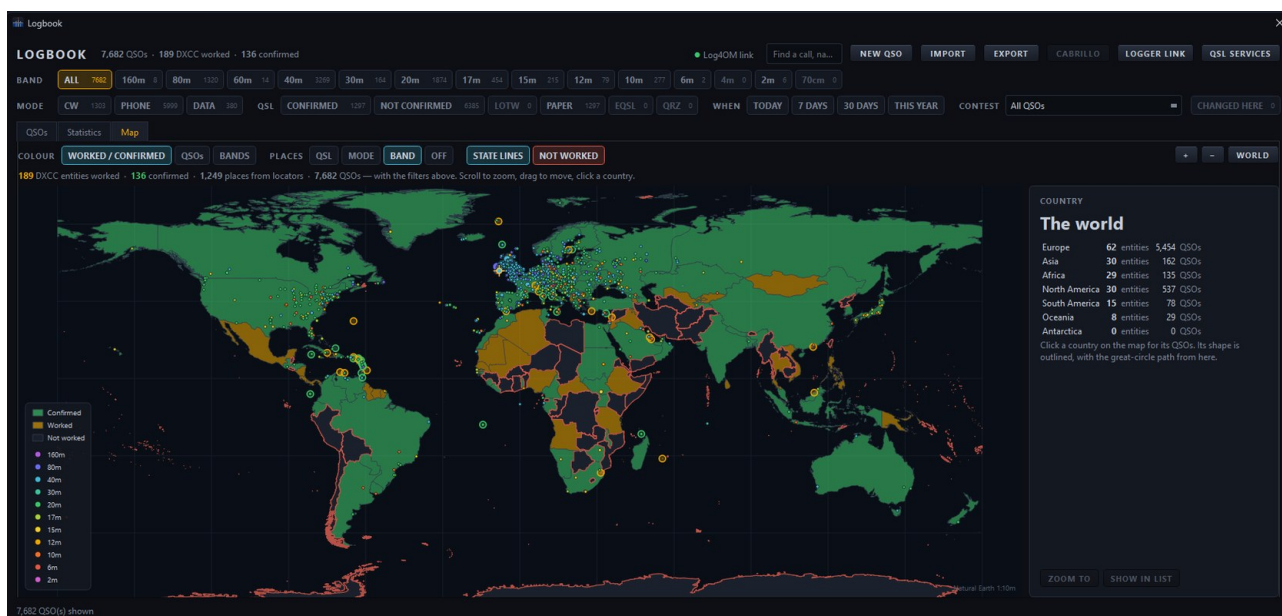
Statistics for the whole log: 7,682 QSOs, 189 DXCC entities worked and 136 confirmed, then DXCC worked and confirmed on each band in CW, phone and data, the QSOs and entities for each year, and the countries worked most.

Four figures across the top — QSOs, DXCC worked, DXCC confirmed, and DXCC confirmed on LoTW — and three tables under them:

- **DXCC by band and mode:** on each band, how many entities you have worked and how many are confirmed, in CW, phone, data and all modes together, written as *worked / confirmed*.
- **By year:** the QSOs, and the entities worked, in each year.
- **Most worked countries:** the countries with the most QSOs, and how many of those are confirmed.

The statistics follow the filters, so choosing 20m, or CW, or THIS YEAR gives the figures for just that.

The Map tab



The whole log on the map. Countries confirmed are green, worked but not confirmed amber, and not worked dark, with NOT WORKED outlining them in red. Each dot is a place you have worked, from its locator, coloured by band. The card on the right counts entities and QSOs on each continent.

Every country you have worked is shaded, and every QSO with a locator is a dot at the place it came from. The map follows the filters, so it can show just one band, one mode or one year.

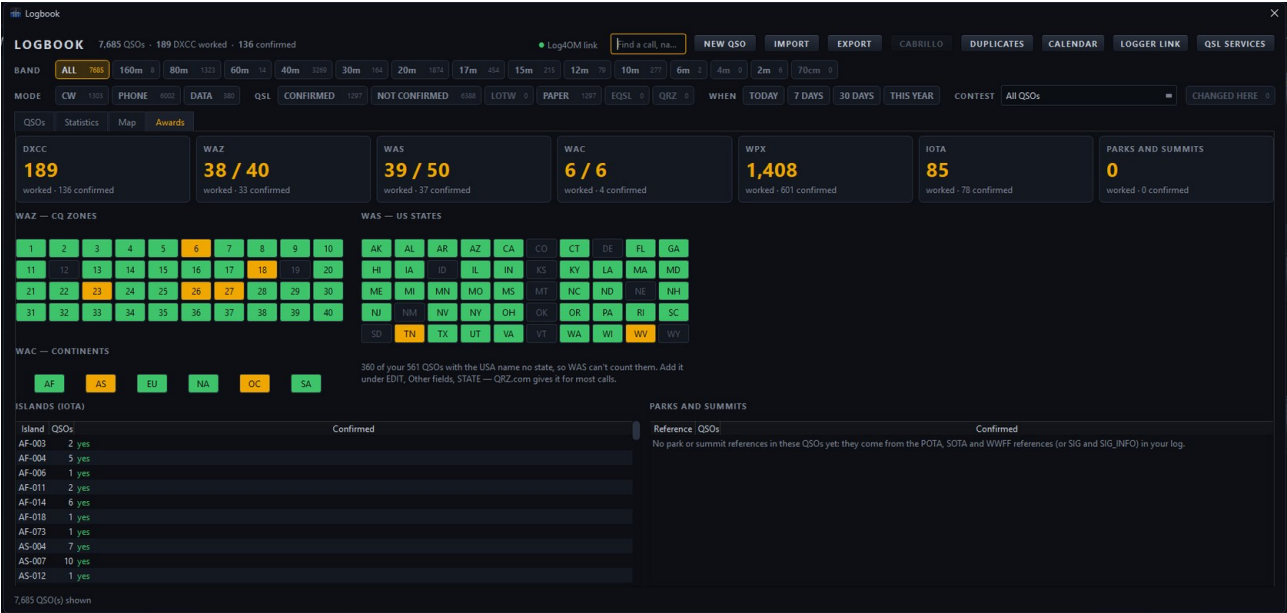
Control	What it does
COLOUR	What the shading shows. WORKED / CONFIRMED : green for confirmed, amber for worked, dark for not worked. QSOs : how many QSOs with each country. BANDS : on how many bands you have worked it.
PLACES	The dots, coloured by QSL status, by MODE or by BAND , or OFF to hide them. The key at the bottom left says what each colour means.
STATE LINES	The borders of states, provinces and counties, drawn once you have zoomed in.
NOT WORKED	Outlines in red every DXCC entity you have not worked with the filters as they are: the ones still to get.
+, -, WORLD	Zoom in, zoom out, or back to the whole world. The mouse wheel zooms too, and dragging moves the map.

The pointer turns into a hand over a station, so it is easy to pick one out. **Click a country** and the card on the right shows it: how many QSOs and how many confirmed, the first and the last, the bands, and the QSOs themselves. The country is outlined, with the great-circle path from your station to it. **ZOOM TO** fills the map with it, and **SHOW IN LIST** takes you to the QSOs tab with only that country's QSOs

listed; click the country's key on the filter row to show them all again.

The map comes from Natural Earth, at a scale of 1:10 million, so coasts and small islands are drawn in detail. Its countries are matched to the DXCC entities; the few entities too small to draw are shown as a ring.

The Awards tab



The Awards tab for the whole log. Across the top, a figure for each award. Under them, the 40 CQ zones, the six continents and the 50 US states: green confirmed, amber worked but not confirmed, dark not worked yet. At the bottom, the islands and the parks worked.

How far you have got with the best-known awards, worked out from your log. Each figure across the top shows how many you have worked, with the number confirmed under it:

Award	What is counted
DXCC	DXCC entities (countries), from the log's DXCC numbers.
WAZ	Worked All Zones: the 40 CQ zones.
WAS	Worked All States: the 50 US states. Each QSO with the USA needs its state in the log. Alaska and Hawaii count without one, since the country says which state it is.
WAC	Worked All Continents: Africa, Asia, Europe, North America, Oceania and South America.
WPX	The different callsign prefixes worked, as the CQ WPX award counts them.
IOTA	Islands On The Air: the island references in your log, such as EU-115.
Parks and summits	The POTA, SOTA and WWFF references in your log, and any other activity it names in its SIG fields.

The zones, the continents and the states are drawn as grids of boxes: **green** confirmed, **amber** worked but not confirmed, and **dark** not worked yet. Rest the pointer on a box to see how many QSOs it has. The islands and the parks are listed underneath, each with its QSOs and whether it is confirmed.

The awards follow the filters too. Choose 20m and CW, for example, and the tab shows WAS on 20 metres CW.

If some of your QSOs with the USA have no state, a line under the states says how many. WAS cannot count those QSOs until the state is added: open the QSO with **EDIT** and fill in **STATE** under *Other fields*. QRZ.com gives the state for most US calls.

This tab shows your progress only. It does not apply for an award: each award has its own rules and its own way of checking confirmations, usually LoTW or QSL cards.

Finding duplicates

Duplicates

123 QSOs are in your log more than once — the same call, band and mode within ten minutes. In each group, the copy to keep is marked KEEP.

126 spare copies marked "delete in log4om" are duplicates in log4om itself. Delete them in log4om: they then disappear from here by themselves. They cannot be deleted here, because log4om would put them back.

	Date (UTC)	Call	Band	Mode	QSL	From
KEEP	2009-08-19 20:24:17	3A/F8ATS	20m	SSB		log4om
delete in log4om	2009-08-19 20:27:22	3A/F8ATS	20m	SSB		log4om
delete in log4om	2011-06-05 23:05:06	4K6FO	20m	CW		log4om
KEEP	2011-06-05 23:05:44	4K6FO	20m	CW	yes	log4om
KEEP	2008-04-09 22:15:00	4O3A	40m	SSB	yes	log4om
delete in log4om	2008-04-09 22:17:00	4O3A	40m	SSB	yes	log4om
delete in log4om	2008-04-14 16:53:00	4Z4DX	20m	SSB	yes	log4om
KEEP	2008-04-14 16:55:00	4Z4DX	20m	SSB	yes	log4om
delete in log4om	2008-04-14 16:59:00	4Z4DX	20m	SSB		log4om
delete in log4om	2011-01-30 11:18:28	5B4AIF	15m	SSB		log4om
KEEP	2011-01-30 11:20:27	5B4AIF	15m	SSB	yes	log4om
delete in log4om	2008-04-07 20:27:00	5D0IPY	20m	SSB		log4om
KEEP	2008-04-07 20:28:00	5D0IPY	20m	SSB		log4om

DELETE SELECTEDCLOSE

The Duplicates window for a log kept in Log4OM. Each group is one QSO in the log more than once, with the copy to keep marked KEEP. Here every spare copy is a duplicate inside Log4OM itself, marked *delete in Log4OM*, so there is nothing to delete in this window and DELETE SELECTED stays greyed: they are deleted in Log4OM instead.

Sometimes the same QSO ends up in the logbook more than once. **DUPLICATES**, at the top of the Logbook window, finds them: the same call, on the same band and mode, logged within ten minutes of each other. Each QSO that is in the log more than once is shown as a group, and the copy to keep is marked **KEEP** — the one with the most confirmations, or else the most details filled in.

Each spare copy is marked with where to delete it:

Marked	What it means, and what to do
delete	A copy made in this application, or imported from a file. It can be deleted here, and it stays deleted. These copies are already selected: press DELETE SELECTED .

delete in Log4OM	A duplicate inside your logging program's own log (the name shown is your program's). Delete it there. The logger link then removes it from here by itself. It cannot be selected here, because if it were deleted only here, the link would put it back the next time it reads your logging program's log.
------------------	---

To change what is deleted here, click a row to select only that one, or **Ctrl+click** to add or remove a row; the key shows how many are selected. You are asked once more before anything is deleted, and **CLOSE** leaves the log as it is. One copy of each QSO always stays.

Your logging program

LOGGER LINK sets up the link with your logging program. It works in both directions, and each half can be used on its own. Nothing changes until you press **OK**.

QSOs made here, sent to your logger.

Setting	What it does
Send each QSO to it	On: every QSO you save is handed to your logger. Off: QSOs are only kept here, and can still be exported as ADIF.
Send as	As <i>WSJT-X</i> does hands a QSO over exactly as <i>WSJT-X</i> hands over its own: the right choice for Log4OM, N1MM Logger+, MacLoggerDX, RUMlogNG and anything behind JTAlert or GridTracker. <i>Plain ADIF</i> sends the QSO as a single ADIF record, for a logger set up to take that instead.
Address	The computer your logger runs on. 127.0.0.1 is this one.
UDP port	The port your logger listens on for <i>WSJT-X</i> . 2237 is <i>WSJT-X</i> 's own, and Log4OM's.

For **Log4OM** the defaults are right and there is nothing to set up: its **INCOMING JT MESSAGE** connection on UDP 127.0.0.1:2237 already takes these QSOs, the same way it takes *WSJT-X*'s. If the logger is not running, QSOs are kept and sent when it starts.

One program per port. If a second UDP connection is added in Log4OM on the same port, or anything else holds 2237, Log4OM cannot open its own listener, and QSOs — *WSJT-X*'s as well as these — stop arriving. Log4OM says so in its UDP log, and only tries again when it is restarted.

Your logger's log, read back here. Choose *Log4OM's logbook* (the application finds it by itself), *An ADIF file your logger keeps* (BROWSE to it), or *Don't read it*, and how often to read it. **READ NOW** reads it at once.

- New QSOs, and changes made in your logger — a QSL confirmed, a name filled in — come into this logbook. When a QSO has been changed in both places, the latest change wins.
- A QSO deleted in Log4OM is deleted here too. As a safeguard, a reading that would delete a large part of the log at once is ignored.
- Your logger's own database is only ever read, never written. An edit made here is marked **CHANGED HERE**: choose that filter and EXPORT those QSOs as ADIF to take the changes across to your logger.

The logbook lives in the application's settings file (section 21), so it moves to another computer along with everything else.

12. Contests

The Log QSO window can log a contest as well as everyday QSOs. Choose the contest in its **Contest** list and the window changes to suit it: the contest's own exchange, serial numbers, a warning for dupes, and a form that stays open, ready for the next QSO, each time you save.

Log QSO

FREQUENCY
3.730.000

BAND
80m

MODE
SSB

STARTED
00:19:00

UTC NOW
00:22:00

THEIR SIGNAL
S8

S-METER

QSO

CONTEST
CQ WW WPX Contest (SSB) · CC

CALENDAR

CALL
JA3ABC

PREFIX
JA

SUFFIX

SENT
RST NR
59 003

AUTO

RCVD
RST NR
59

NAME

QTH

LOCATOR

NOTE

A note for the log

STATION

QRZ

JA3ABC

Japan

NEW BAND FIRST QSO

WORKED BEFORE

None in the log: a first.

Date

Band

Mode

QSL

CQ WW WPX Contest (SSB). Enter saves it and opens the next QSO.

DISCARD

SAVE

A QSO in the CQ WW WPX Contest (SSB). Under the call are the prefix and suffix boxes. The exchange both ways is RST and a serial number, and AUTO has given this QSO 003. The Station card marks JA3ABC as a NEW BAND and a FIRST QSO; a station already worked in the contest would be marked DUPE instead.

Choosing the contest

The **Contest** list holds every contest that ADIF, the logging standard, has a name for: about 250 of them. Type a few letters to find one. Contests that are on now, or later today, are at the top of the list, in colour. **CALENDAR** beside the list opens the contest calendar. Choose *No contest* when you have finished.

For 76 of the best-known contests the exchange is built in. For the rest, the window sends RST and a serial number and writes whatever the other station sends into the log's exchange field, and the line at the bottom says so. Always check the contest's own rules.

What changes in the window

Part	In a contest
Prefix, Suffix	Their WPX prefix, worked out from the call the way the CQ WPX contest counts it, and how they are operating: /P, /M, /MM, /QRP and so on. Both fill in as you type the call; type over either if it is wrong.

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Sent	Your side of the exchange, for example RST and your CQ zone. What you send is remembered for each contest, and your zone starts out as the one your own callsign is in.
Rcvd	Their side. Their zone is filled in from their callsign, outlined so you can see it was not typed; check it against what they send. A box you have typed in keeps your value until the call changes.
Serial number	With the AUTO key lit, each QSO gets the next number in this contest by itself, counted from the contest's QSOs already in the log. Turn AUTO off to type numbers yourself.
Time	Nothing to type: the time is stamped the moment you save.
DUPE	A red badge on the Station card when you have already worked the station in this contest, with a line saying when and on which band.

Enter saves the QSO and opens the next one straight away, with the next serial number, so a run of contacts is just: type the call, check the exchange, press Enter.

How the contest is going. A line under the exchange counts the contest so far, from your log: the QSOs, the bands, the countries, the zones and the prefixes worked, and the QSOs in the last hour and the last ten minutes, which give your rate. It is brought up to date with every QSO you save.

The tally counts; it does not score. Every contest scores in its own way, with its own points and multipliers, and a wrong score would be worse than none. The counts are the raw material for most of them.

In a contest, QRZ.com is not asked about each call and no photo is fetched: there is no time to read them, and no point loading the connection. Your own log is still read, for dupes and earlier QSOs.

Sending your log in

In the Logbook window, choose the contest and year under **CONTEST**. The list then shows that contest's QSOs only, and:

- **EXPORT** writes them as an ADIF file, named after the contest, the year and the date, for contests that accept ADIF;
- **CABRILLO** writes a Cabrillo log, the format most contest sponsors ask for.

Cabrillo log — CQ WW WPX Contest (SSB)

CONTEST

CQ-WPX-SSB

CALLSIGN

EI5GJB

LOCATION

DX

CATEGORY-OPERATOR

SINGLE-OP

CATEGORY-ASSISTED

NON-ASSISTED

CATEGORY-BAND

80M

CATEGORY-MODE

SSB

CATEGORY-POWER

LOW

CATEGORY-STATION

—

CATEGORY-TRANSMITTER

—

CATEGORY-TIME

—

CATEGORY-OVERLAY

—

CERTIFICATE

YES

CLAIMED-SCORE

CLUB

NAME

EMAIL

GRID-LOCATOR

IO51XU

OPERATORS

THE LOG, AS IT WILL BE WRITTEN — 2 QSO(S)

START-OF-LOG: 3.0

CONTEST: CQ-WPX-SSB

CALLSIGN: EI5GJB

LOCATION: DX

CATEGORY-OPERATOR: SINGLE-OP

CATEGORY-ASSISTED: NON-ASSISTED

CATEGORY-BAND: 80M

CATEGORY-MODE: SSB

CATEGORY-POWER: LOW

CERTIFICATE: YES

CREATED-BY: TS-890S Desktop 2.4.0

GRID-LOCATOR: IO51XU

QSO: 3730 PH 2026-10-11 0003 EI5GJB 59 001 WIABC 59

QSO: 3730 PH 2026-10-11 0004 EI5GJB 59 002 WIABC 59

END-OF-LOG:

2 QSO(s) with no exchange received.

CANCEL

SAVE LOG

The Cabrillo window for the CQ WW WPX Contest (SSB). The header fields are on the left, with your locator already filled in; on the right is the log exactly as it will be written. The line at the bottom warns that two QSOs have no exchange received.

The Cabrillo window has the log's header on the left, with a list for each **CATEGORY** field holding the values the Cabrillo standard allows, and boxes for the rest: your callsign, location, club, operators, address and a few words for the soapbox. Rest the pointer on a box for what it wants. Your station's details are remembered for next time. On the right is the log exactly as it will be written, and the line at the bottom warns of anything missing — QSOs with no exchange, say. **SAVE LOG** writes the file.

The application does not work out your score: type it in CLAIMED-SCORE if the sponsor wants it, or leave it empty. Frequencies are written in kHz on HF and as the band from 50 MHz up, as the standard asks.

The contest calendar

CONTEST CALENDAR 7 DAYS 30 DAYS 90 DAYS THIS YEAR WEEKLY Find a contest... RSGB UPDATE

ON NOW AND LATER TODAY (UTC)

ON NOW
Oceania DX Contest (CW)
7 h 45 min left - ends Sun 0559Z
USE

ON NOW
Scandinavian Activity Contest (SSB)
13 h 45 min left - ends Sun 1159Z
USE

When (UTC)	Contest	Status	ADIF	From
Sat 10 Oct 0600Z – Sun 11 Oct 0559Z	Oceania DX Contest (CW)	ON NOW - 7 h 45 min left	OCEANIA-DX-CW	sponsor's rules
Sat 10 Oct 1200Z – Sun 11 Oct 1159Z	Scandinavian Activity Contest (SSB)	ON NOW - 13 h 45 min left	SAC-SSB	sponsor's rules
Wed 14 Oct 1900Z – 2029Z	Autumn Series DATA	in 4 days	—	RSGB calendar
Sat 17 Oct 1500Z – Sun 18 Oct 1459Z	DARC Worked All Germany	in 7 days	DARC-WAG	sponsor's rules
Thu 22 Oct 1900Z – 2029Z	Autumn Series SSB	in 12 days	—	RSGB calendar
Sat 24 Oct 0000Z – Sun 25 Oct 2359Z	CQ WW DX Contest (SSB)	in 13 days	CQ-WW-SSB	sponsor's rules
Mon 26 Oct 2000Z – 2159Z	RSGB FT4 Contest	in 16 days	—	RSGB calendar
Sat 31 Oct 1200Z – Sun 1 Nov 1159Z	UKEI DX SSB Contest	in 21 days	—	RSGB calendar
Mon 2 Nov 2000Z – 2129Z	Autumn Series DATA	in 23 days	—	RSGB calendar
Sat 7 Nov 2100Z – Mon 9 Nov 0259Z	ARRL November Sweepstakes (CW)	in 28 days	ARRL-SS-CW	sponsor's rules

10 contests shown. Dates from each sponsor's rules, and the RSGB's own from the RSGB Contest Committee calendar (rsgbcc.org). Always check the contest's own rules before you operate. **USE IN LOG QSO**

RSGB calendar for 2026: 55 contests.

The contest calendar, showing the next 30 days. Two contests are on now, each with the time left and a USE key. In the list below, the ADIF column gives the name each contest has in the Contest list, and the From column says where its dates came from.

CALENDAR, in the Logbook window or beside the Contest list, opens it. Across the top, the boxes show what is on now and what starts later today, with the time left; **USE** sets the Log QSO window up for that contest. Below them is everything coming up:

- **7 DAYS**, **30 DAYS**, **90 DAYS** and **THIS YEAR** set how far ahead to look. **WEEKLY** adds the weekly sprints, such as the CWops CWT, which run three times a week.
- The find box narrows the list to contests whose name contains what you type.
- **Double-click** a contest, or select it and press **USE IN LOG QSO**, to log QSOs in it. A contest with no name in ADIF's list is logged with no contest chosen.

The dates come from two places, and the **From** column says which. Most are worked out from each sponsor's own rules (the CQ WW DX contest on the last full weekend of October, for example), and each rule was checked against the sponsor's published dates. The RSGB's contests come from the RSGB Contest Committee's own calendar, which the application fetches once a day; **RSGB UPDATE** fetches it again now.

A calendar is only a guide. Dates and times do change, so always check the contest's own rules before you operate.

13. QSL services, and who is hearing you

QSL services: QRZ.com and Logbook of the World

QSL SERVICES, in the Logbook window, connects the logbook to QRZ.com and to the ARRL's Logbook of the World (LoTW): looking up the stations you work, sending your QSOs, and fetching the confirmations back into the log.

The screenshot shows a window titled "QSL services" with a close button (X) in the top right corner. The window is divided into two main panels. The left panel is for QRZ.com and the right panel is for Logbook of the World.

QRZ.com

CALLSIGN LOOKUP

Username:

Password:

TEST LOGIN ☒ Look calls up as they are typed in a QSO

Any QRZ.com account can log in; the full record — name, address, locator — needs a QRZ XML subscription.

QRZ LOGBOOK

API key:

TEST KEY ☐ Send each QSO as it is logged

The key is on qrz.com: your Logbook, then Settings. Sending QSOs and fetching confirmations need a subscription.

7,455 QSOs not yet sent to the QRZ Logbook.

SEND UNSENT **FETCH CONFIRMATIONS**

Logbook of the World

SENDING: TQSL

TQSL is not installed. Get it from [the ARRL's LoTW pages](#). **TQSL...**

Station Location:

☐ Send each QSO as it is logged

Only ARRL's TQSL can sign QSOs with your callsign certificate: the QSOs are handed to it, and it signs and uploads them. Set up your certificate and a Station Location in TQSL first. QSOs LoTW has already are skipped.

CONFIRMATIONS: YOUR LOTW WEBSITE LOGIN

Username:

Password:

TEST LOGIN

875 QSOs not yet sent to LoTW.

SEND UNSENT **FETCH CONFIRMATIONS**

FORGET LOGINS Logins are kept by Windows, encrypted for your Windows account (Control Panel > Credential Manager), never in this application's files. **CLOSE**

QSL services. On the left, QRZ.com: the callsign lookup login and the QRZ Logbook's API key. On the right, Logbook of the World: TQSL for sending, and your LoTW website login for fetching confirmations. Each side counts the QSOs not yet sent.

QRZ.com has two parts:

Part	What it does
Callsign lookup	Your QRZ.com username and password. TEST LOGIN checks them. With <i>Look calls up as they are typed in a QSO</i> ticked, the Log QSO window fills in the name, QTH and locator and shows the photo as you type a call. Any QRZ.com account can log in, but the full record — address, locator, photo — needs a QRZ XML Data subscription.
QRZ Logbook	The API key of your logbook on QRZ.com; you find it on qrz.com under your Logbook, then Settings. TEST KEY checks it. SEND UNSENT sends every QSO not yet there, and <i>Send each QSO as it is logged</i> sends each new one as you save it. FETCH CONFIRMATIONS marks the QSOs QRZ.com has confirmed. Sending QSOs and fetching confirmations need a QRZ.com subscription.

Logbook of the World also has two parts:

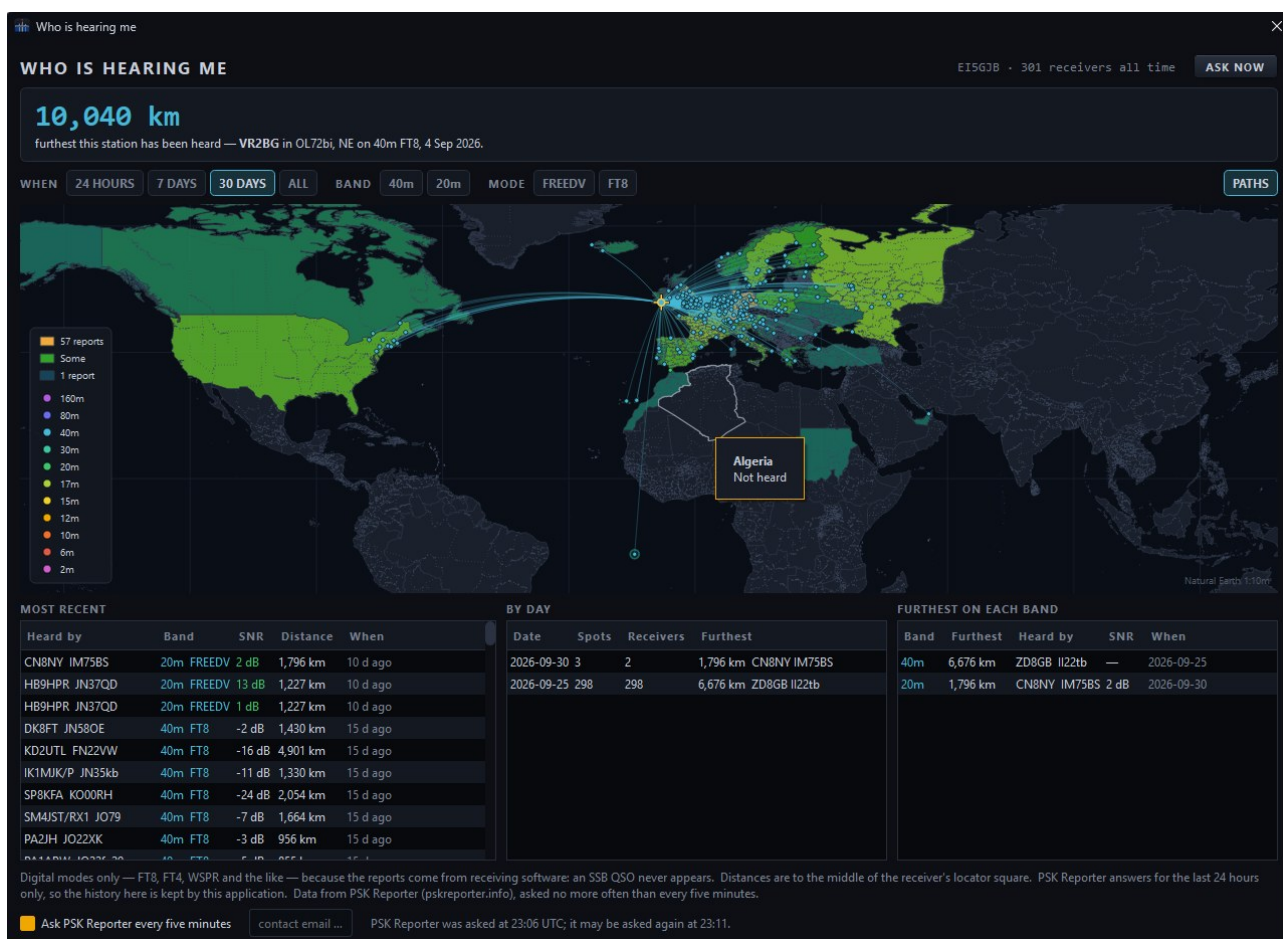
Part	What it does
Sending: TQSL	Only the ARRL's own program, TQSL, can sign QSOs with your callsign certificate, so the application hands your QSOs to TQSL and TQSL signs them and uploads them. Install TQSL and set up your certificate and a Station Location in it first; the window says if it cannot find TQSL, and TQSL... lets you show it where TQSL is (tqsl.exe on Windows, tqsl.app on a Mac). Choose the Station Location , then SEND UNSENT , or tick <i>Send each QSO as it is logged</i> . QSOs LoTW already has are skipped.
Confirmations	Your LoTW website username and password. FETCH CONFIRMATIONS marks the QSOs LoTW has confirmed. The application also fetches new confirmations by itself every six hours while it runs.

Confirmations show up throughout the logbook: as the filled letters in the QSL column, under the CONFIRMED and LOTW filters, in the statistics, and in green on the map.

Your logins are kept by Windows, encrypted for your Windows account (you can see them in Control Panel, under Credential Manager), or on a Mac in your Keychain (Keychain Access shows them), and never in the application's own files. **FORGET LOGINS** removes them all.

Who is hearing me: the PSK map

PSK MAP, on the bar across the top of the main window, shows every station that has reported hearing you on PSK Reporter, on a map of the world. It answers the question every operator asks after calling CQ on FT8: *is anybody hearing me, and how far am I getting?*



Who is hearing me, over the last 30 days. The furthest report is across the top: VR2BG in Hong Kong, 10,040 km away on 40 m FT8. On the map, each country is shaded by how many reports came from it and each dot is a receiver, coloured by band, with PATHS drawing the great-circle path to each. Below the map: the most recent reports, the reports for each day, and the furthest on each band.

Part	What it shows
The headline	The furthest you have been heard: the distance, the station, their locator, the direction, the band and mode, and the date.
WHEN, BAND, MODE	Narrow the reports to the last 24 HOURS, 7 DAYS or 30 DAYS, or ALL of them, and to one band or one mode. Only the bands and modes you have reports for are offered.
PATHS	Draws the great-circle path from you to each station that heard you.
The map	Countries shaded by how many reports came from each, and each receiver as a dot, coloured by band. Rest the pointer on a country for its count.
Most recent	Each report: who heard you, the band and mode, the signal-to-noise ratio, the distance and how long ago.
By day	How many reports and receivers on each day, and the furthest.
Furthest on each band	The longest distance on each band, and who heard you.
ASK NOW	Asks PSK Reporter for new reports straight away.

With **Ask PSK Reporter every five minutes** ticked, the map keeps itself up to date. The callsign it asks about is your own, from **EDIT** in the macros.

Only digital modes appear — FT8, FT4, WSPR and the like — because the reports come from receiving software, so an SSB QSO never will. PSK Reporter only answers for the last 24 hours, so the history here is kept by the application itself, from what it has fetched. Distances are to the middle of the receiver's locator square. PSK Reporter asks programs not to ask more often than every five minutes, and its author asks frequent users for a contact address: the box beside the tick is for that, and is only sent if you fill it in. The data is from pskreporter.info.

14. The DX cluster

RADIO → **DX cluster** shows the spots other operators post: who is on the air, where, and in what mode. Spots for stations you need are picked out in colour, a double-click tunes the radio to one, and spots can be shown on the bandscope too.

DX CLUSTER ● Spothole ● DXSpider G1FEF ● AR-Cluster NC7J

FIND A CALL, CO... SOURCES DISCONNECT

BAND ALL 250 160m 0 80m 0 60m 0 40m 58 30m 0 20m 97 17m 18 15m 55 12m 8 10m 16 6m 2 4m 0 2m 6

MODE CW 34 PHONE 58 DATA 23 ACTIVITY DX 21 POTA 32 SOTA 1 WWFF 2 OTHER 2

NEW ONLY SKIMMERS ON SCOPE

AGE	KHZ	DX	COUNTRY	BAND	MODE	REF	SPOTTER	SOURCE	COMMENT
now	7278.0	KE4GOI	United States	40m	SSB	US-7443	KE4GOI +3	POTA	55 MO 73
now	7226.0	AF8OW	United States	40m	SSB	US-9425	AF8OW +5	POTA	53 EAST TN
now	7177.0	WB8MR	United States	40m	SSB	US-1973	KC8D	POTA	ssb
now	7187.0	N3XLS	United States	40m	SSB	US-9720	N3XLS +1	Cluster +3	WWFF KFF-6095
1m	7287.0	VE9MY	Canada	40m	SSB	CA-0779	VE2GT	Cluster +5	ssb with VE9GLF
1m	7194.0	W4O	United States	40m	SSB	US-0521	KR4MES +1	POTA	51 EAST TN
2m	7238.0	W8GLR	United States	40m	SSB	US-7045	W8GLR +1	POTA	CQ W/KD8MIV
2m	7196.0	SQ9XPM	Poland	40m	SSB	SP/8Z-040	SQ9XPM +1	POTA +2	3-fer: PL-1234 PL-2776 PL-2016
2m	7238.0	KD8MIV	United States	40m	SSB	US-7045	W8DMB	POTA	
3m	7235.0	KC1NE	United States	40m	SSB	US-3779	W3BAY +8	POTA	59 Mo
3m	7235.0	KC1NE	United States	40m	SSB	US-3779	W3BAY +8	POTA	59 Mo
3m	7235.0	KC1NE	United States	40m	SSB	US-3779	KO4US +9	POTA	59 Mo
3m	7235.0	NA4HX	United States	40m	SSB	US-3779	W3BAY +7	POTA	59 Mo
3m	7235.0	NA4HX	United States	40m	SSB	US-3779	KO4US +8	POTA	59 Mo
3m	7265.0	KE2HPS	United States	40m	SSB	US-6462	KE2HPS +1	POTA	SSB
3m	7113.0	DL7PIA	Germany	40m	SSB		IU1NSA	Cluster +1	Youth WWA 2026 ssb
4m	7278.0	KE4GOI	United States	40m	SSB	US-7443	KE4GOI +2	POTA	Qsy
4m	7278.0	KE4GOI	United States	40m	SSB	US-7443	KE4GOI +2	POTA	Qsy
5m	7197.0	W8RNB	United States	40m	SSB	US-1495	W8RNB +4	POTA	Thx for QSO. 59 in FM07Jf. 73 K4HXM via POTACAT
5m	7138.0	IQ00J	Italy	40m	SSB		IW0QLQ	Cluster	Award St. Francis of Assisi ss
5m	7137.0	ON5QP	Belgium	40m	SSB		O000	Cluster	bafara award

58 spot(s) shown of 521 in the last hour

SELECTED SPOT
DL7PIA
Germany · EU
LoTW
7,113.0 kHz · SSB · 40m
1,255 km · 100° from here (JN48KN)
Spotted by IU1NSA
via Cluster, DXSpider G1FEF · 13:47 UTC (3m)
"Youth WWA 2026 ssb"

TUNE SPOT IT QRZ

SPOT A STATION
kHz FROM RADIO DX calli...
comment, e.g. CW 599 up 2
VIA DXSpider G1FEF SEND SPOT

The DX cluster, showing 40 m phone spots. The sources across the top are all connected. Each spot shows its age, frequency, callsign, country, band, mode, park reference, spotter and source. DL7PIA is selected, and the card on the right gives the distance and bearing, who spotted them and when. Under it is the box for sending a spot of your own.

Where the spots come from

SOURCES chooses them:

- **Spothole** (spothole.app), a free public service run by Ian Renton, M0TRT. It gathers the spots from the DX cluster network and the parks-and-summits programmes — POTA, SOTA, WWFF and more — with each spot's country and mode already worked out. It is receive only.
- **The Reverse Beacon Network** (reversebeacon.net): receivers around the world, called skimmers, that decode CW and RTTY by themselves and report every station they hear calling. With **SKIMMERS** on, the application connects to it directly, logging in with your callsign. It is receive only. Untick *Skimmer spots straight from the RBN* to leave it out. **Skimmers in** keeps only the spots of skimmers on your continent (the starting choice), in your country, or anywhere in the world, so that the stations named are ones you can probably hear.
- **Telnet cluster nodes**: the traditional DX cluster nodes, as many as you like. Each is **On** (always connected), **Standby** (connected only while Spothole cannot be reached, the first in the list that answers) or **Off**. A standard list of standby nodes is provided. A node needs your callsign to log in, which is taken from your station details, and **At login** holds commands to send it straight after: *sh/dx 30*, for example, fills the list with its last thirty spots.

Connect when the application starts does just that. **CONNECT** and **DISCONNECT** in the window's title row do it by hand, and the lamps beside the title show which sources are connected.

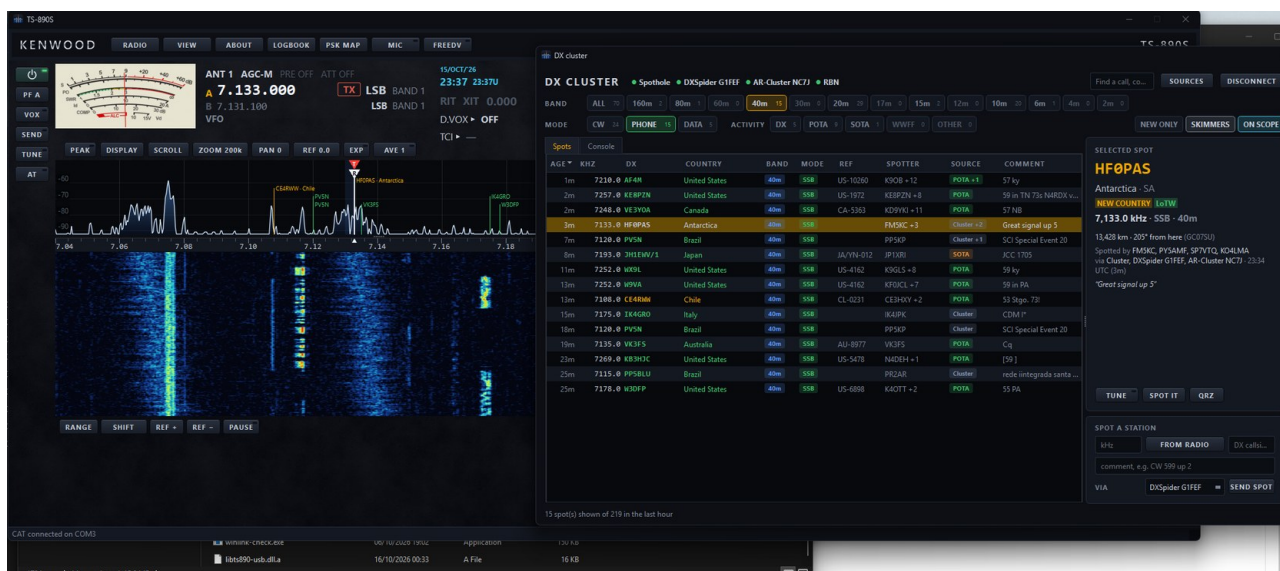
Choosing what you see

Filter	What it does
Find box	Type part of a call, a country or a park reference.
BAND	Click a band to see only that band; Ctrl+click adds another. Each key counts its spots.
MODE	CW, PHONE or DATA.
ACTIVITY	DX for ordinary spots, or the activations of POTA parks, SOTA summits, WWFF areas and OTHER programmes.
NEW ONLY	Only countries that are not in your log, or not yet on that band.
SKIMMERS	Adds the spots from the Reverse Beacon Network's CW and RTTY skimmers. There are a great many of them.
ON SCOPE	Names the last half hour's spots on the bandscope, with the filters as they are.

A callsign in **amber** is a country that is not in your log; in **cyan**, one you have worked but not on this band. These are the same DXCC alerts as on the bandscope (section 8). The same station spotted again on the same band within ten minutes stays on one row, and its source shows how many more spots there have been, such as *Cluster +3*. Spots are kept for an hour.

Callsigns on the bandscope

With **ON SCOPE** lit, the spots are named on the bandscope, each callsign at the frequency it was spotted on, so you can see who is where on the band at a glance. Turn on **SKIMMERS** as well and the bandscope fills with the stations the Reverse Beacon Network's skimmers hear calling right now.



40 m with the DX cluster open beside the panel, SKIMMERS and ON SCOPE lit. The spotted stations are named on the bandscope above their signals. HF0PAS in Antarctica is selected; it is a new country, so it is shown in amber, on the bandscope as well as in the list.

The labels follow the window's filters: choose 40 m and CW, for example, and only those are named. They show the last half hour's spots, and the colours are the same as in the list.

Skimmers far away may hear stations you cannot. **Skimmers in**, under SOURCES, keeps only those on your continent to begin with; choose your country for nearer still, or anywhere to see everything.

Working a spot

Click a spot and the card on the right shows it: the call, country and continent, whether they use LoTW, the frequency, mode and band, the distance and bearing from you, who spotted it, through which source and when, and the comment.

Key	What it does
TUNE	Tunes the radio to the spot, in its mode. A double-click on a spot does the same.
SPOT IT	Puts the station in the box below, ready to spot it yourself.
QRZ	Opens the station's QRZ.com page in your web browser.

The mode is taken only from what the spot says: its own mode, or a word in its comment such as CW, SSB or FT8. If it says nothing, the radio stays in the mode it is in. For a data spot, such as FT8, the dial goes 1.5 kHz below the spotted frequency, so the signal lands in the middle of the audio.

Sending a spot

Under **Spot a station**: the frequency in kHz (**FROM RADIO** fills it in, with the radio's mode in the comment), the DX callsign, and a comment such as *CW 599 up 2*. **Via** chooses the telnet node it goes out through, and **SEND SPOT** asks once more before sending, because everyone on the cluster network will see it. Spots can only be sent through a telnet node, since Spothole only listens; if none is connected, the application connects to one first.

The **Console** tab shows what a telnet node says, and has a line for typing commands to it, such as *sh/dx 50* or *sh/www*.

Remote receivers: hear yourself from far away

RADIO → **Remote receivers**, or the **REMOTE RX** key on the top row (its lamp is lit while you are listening), lists the KiwiSDRs and UberSDRs: receivers covering 0–30 MHz that their owners make public, over nine hundred of them around the world. Each row says which kind it is, where it is and in which country, how far away and in which direction, how many are listening and how many may, its signal-to-noise and its antenna. The nearest are at the top; click a column heading to sort by it.

Both kinds are listened to the same way, with the same meter, waterfall, filter and recording. An UberSDR sends its audio as Opus, so it sounds clean even over a slow connection, and its S-meter reads in dBFS on the same S scale. An UberSDR that can also act as a KiwiSDR is in both lists; it is shown once, as an UberSDR.

The receivers send their audio at a low sample rate. The application converts it to your sound card's own rate itself, carefully, so a receiver sounds as full here as it does in a browser.



Listening to EI4HQ's UberSDR in Cobh on 3.776 MHz, following the dial, with the filter the same as the radio's. The panel at the top says who and where, how long, and the minutes left; the receiver's own S-meter (S9+1 here); FOLLOW, FILTER, VOLUME, QUIET RADIO, MUTE ON TX and NAME THERE. Below the list, the receiver's waterfall with the radio's R and T markers and the passband shaded.

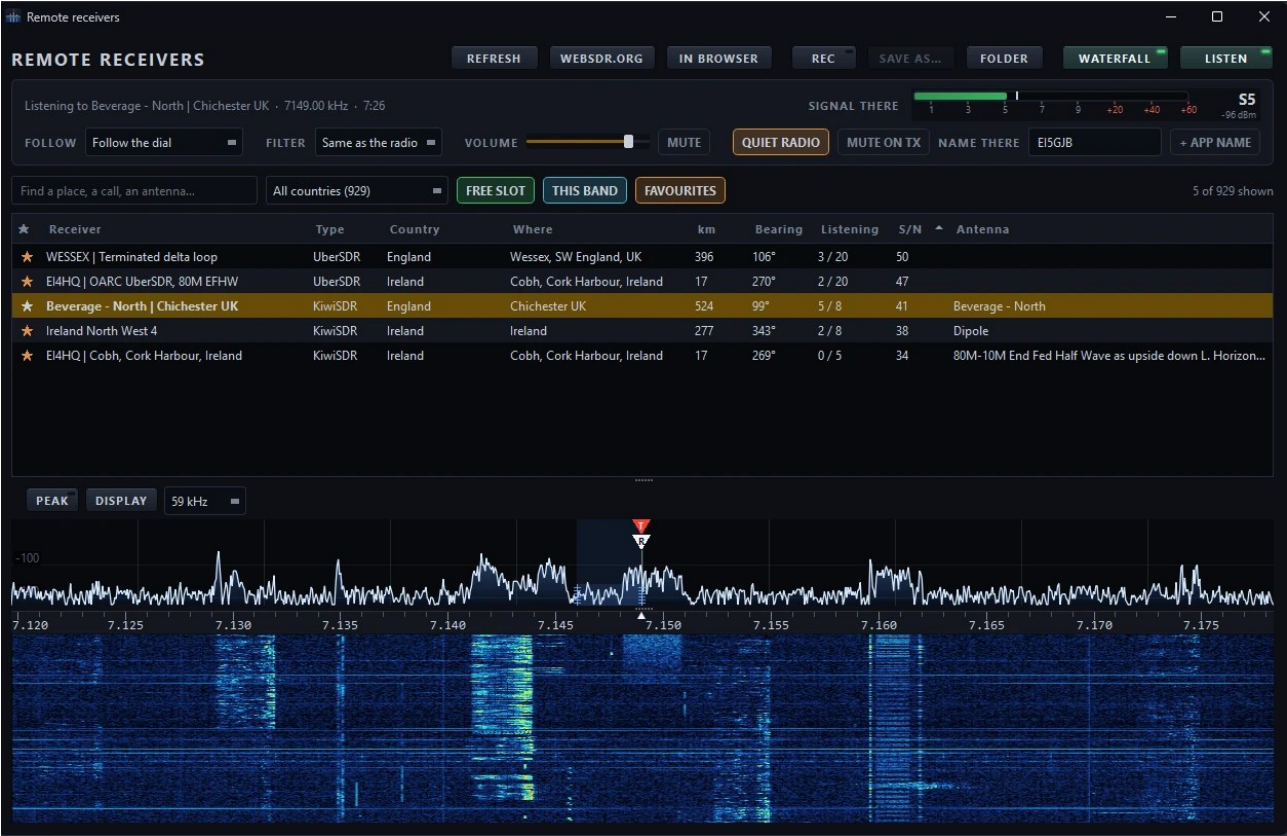
- **FREE SLOT** shows only receivers with room for another listener, and **THIS BAND** only those that cover the frequency the radio is on. Type in the box to find a place, a country, a callsign or an antenna.
- **Favourites.** Click the star at the start of a row to make that receiver a favourite: it turns amber. Click it again to take it off. **FAVOURITES**, beside **THIS BAND**, then shows only your favourites, and a click on the star column's heading sorts them to the top. Your favourites are kept when the lists are fetched again and from one day to the next.
- The country list shows the receivers in one country, with how many each has. The country comes from where the receiver is on the map, not from what its owner typed, so a receiver in Cobh is in Ireland however it is spelt. The country chosen is kept for next time.
- Double-click a receiver, or select it and press **LISTEN**, and its audio plays through the same speakers as the radio's. Press **LISTEN** again to stop. Everything about the receiver you are listening to is in the panel above the list: what it is and how long you have listened, its S-meter, and under them how it is tuned and heard (**FOLLOW**, **FILTER**, **VOLUME** and **MUTE**, **QUIET RADIO** and **MUTE ON TX**).
- **NAME THERE** is the name a KiwiSDR's owner sees in its list of listeners. It starts as your callsign from the station settings; type any other name instead, or clear it to give none, as many browser listeners do. **+ APP NAME** adds the application's name after it. A change reaches a KiwiSDR you are listening to at once. UberSDRs keep no names.
- It is tuned with the radio. **Follow where I transmit** keeps it on your transmit frequency, split and XIT included: transmit, and you hear your own signal as that part of the world hears it, a second or two

later. **Follow the dial** keeps it where the radio is listening, to compare.

- **Tune it here** lets go of the radio and tunes the receiver on its own, as on a KiwiSDR's own page. A **TUNING THERE** row appears: type a frequency in kHz (or MHz, as 7.199) and press Enter; step up and down with **▲** and **▼** by the step chosen beside them, from 10 Hz to 10 kHz (9 kHz suits medium wave in Europe); choose **LSB**, **USB**, **CW**, **AM** or **FM**; and go to a band from the **Band** list, the amateur bands and the broadcast bands from LW and MW up to 11 m. Choosing a band tunes to it in its usual mode and widens the waterfall to show all of it. On the waterfall a click tunes the receiver, the mouse wheel steps it (with Shift, in tenths of a step) and a drag slides it, and its marker is the receiver's own frequency. The filter list follows the receiver's own mode, its first choice being **Normal**. Where it was tuned is kept for next time.
- **SIGNAL THERE** is the receiver's own S-meter, as a bar: S1 to S9 in green, +20 to +60 in red, with the strongest moment held for a second as a white line, and the reading in S units and dBm beside it (dBFS on an UberSDR, on the same S scale). Following where you transmit, key up and watch your own signal arrive.
- **Filter** sets the receiver's bandwidth. **Same as the radio** copies your radio's own receive filter, set as low and high cut or as width and shift, and follows it as you change it; or choose a width: 1.8 to 5.7 kHz in SSB, 50 Hz to 1 kHz in CW (centred on your pitch), 4 to 12 kHz in AM. Your choice is kept for each kind of mode.
- **Custom**, at the end of the Filter list, lets you set the filter's edges yourself: **LOW** and **HIGH** appear beside it, in hertz of audio, so 100 and 3500 passes 100 Hz to 3.5 kHz. (In AM and FM there is one box, **EITHER SIDE**: how far the filter reaches either side of the carrier.) You can also drag the edges of the shaded passband on the receiver's waterfall, along the bottom of the trace; that switches to Custom with the new edges. Each kind of mode keeps its own custom filter.
- How wide a receiver can go: in SSB, CW and data about **5.9 kHz**, because the receivers send that audio sampled at 12 kHz; in AM and FM, about 5.9 kHz either side on a KiwiSDR and 11.9 kHz on an UberSDR. The boxes stop there, as asking for more gets nothing wider.
- **REC** records what the receiver plays to a WAV file in the recordings folder, named for the receiver, the frequency and the time; press it again to stop. The status line says where it went. **SAVE AS...** saves a copy of it wherever you choose, and **FOLDER** opens the folder.
- **MUTE**, beside VOLUME, silences the receiver but stays connected: you keep your listener slot, SIGNAL THERE and the waterfall carry on, and the sound is back the moment you press it again. On a busy receiver that saves losing your place and waiting for a slot. **LISTEN** is still the way to stop and give the slot back; while muted you are holding one that somebody else could use. A new receiver always starts heard.
- **QUIET RADIO** stops the radio's own audio playing while you listen, so only the remote receiver is heard.
- **MUTE ON TX** silences the remote receiver while your radio transmits, whether from its own PTT, the MIC key, a tune carrier or an RTTY or PSK31 over, and brings it back as soon as the radio is on receive. Useful on a net, where you do not want to hear yourself. Leave it off to hear your own signal as the receiver hears it. It is off to begin with, and remembered.
- Under the list is the receiver's **waterfall**, drawn like the radio's bandscope: the spectrum, the waterfall, the radio's R and T markers, and the shaded passband where the receiver is listening. Key up and you can watch your own signal arrive there. The span list sets how wide it is, from 30 MHz down to 1.8 kHz (Ctrl and the mouse wheel do the same), and the cursor reads in dBm. Click on the waterfall to tune the radio there, as on its own bandscope, and the receiver follows. With *Tune it here*, a click

tunes only the receiver. **WATERFALL** turns it off. Some receivers have fewer waterfalls than listener slots; if none is free, the window says so and the audio carries on without it.

- **IN BROWSER** opens the receiver's own page, on the same frequency. If it is the receiver you are listening to, it is handed over: listening in the app stops first, so the page and the app do not both take one of its few slots. **WEBSDR.ORG** opens the WebSDR receivers in your browser: they have no way for other programs to connect, so they are listened to there.



FAVOURITES on: just the five receivers starred, KiwiSDRs and UberSDRs in England and Ireland, here listening to the Beverage at Chichester on 40 m. The amber stars mark the favourites; click one to take it off. MUTE sits beside VOLUME.



The country list: every country with a receiver, and how many each has. It scrolls; choose one to see only its receivers.

Each receiver belongs to a volunteer, who decides how many may listen and for how long; many end a session after half an hour or an hour (an UberSDR says how long, and the status line counts down the minutes left). The application takes one listener slot at a time and gives it back as soon as you stop or close the window. The KiwiSDR list comes from kiwisdr.com and is fetched at most every six hours; the UberSDR list comes from ubersdr.org and is fetched at most every half hour.

15. Propagation

RADIO → **Propagation** gathers what the sun, the ionosphere and the weather are doing, and what that means for the bands. It has four tabs, and **UPDATE** fetches everything again. The time of the last update is beside it.

Several parts need your locator, to know where you are. It is the one set in the Broadcast schedule window (section 16), which is also the one the macros use.

Space weather



The Space weather tab: twelve figures, each with a word on what it means, a line summing them up, and charts of the planetary K index over three days and the sun's X-rays over the last 24 hours, with the flares marked.

Twelve tiles, each with its figure and a few words on what it means for the bands: the **solar flux** and **sunspot number** (how well the higher bands open), the **A** and **K indices** and the **geomagnetic field** (how disturbed the bands are), **X-rays** (flares, which can black out the daylight side), the **solar wind** and **Bz** (whether a disturbance is coming), the expected **band noise** in S-units, how far south the **aurora** reaches, and NOAA's **scales** and **forecast**. Under the tiles, one line sums it all up in words.

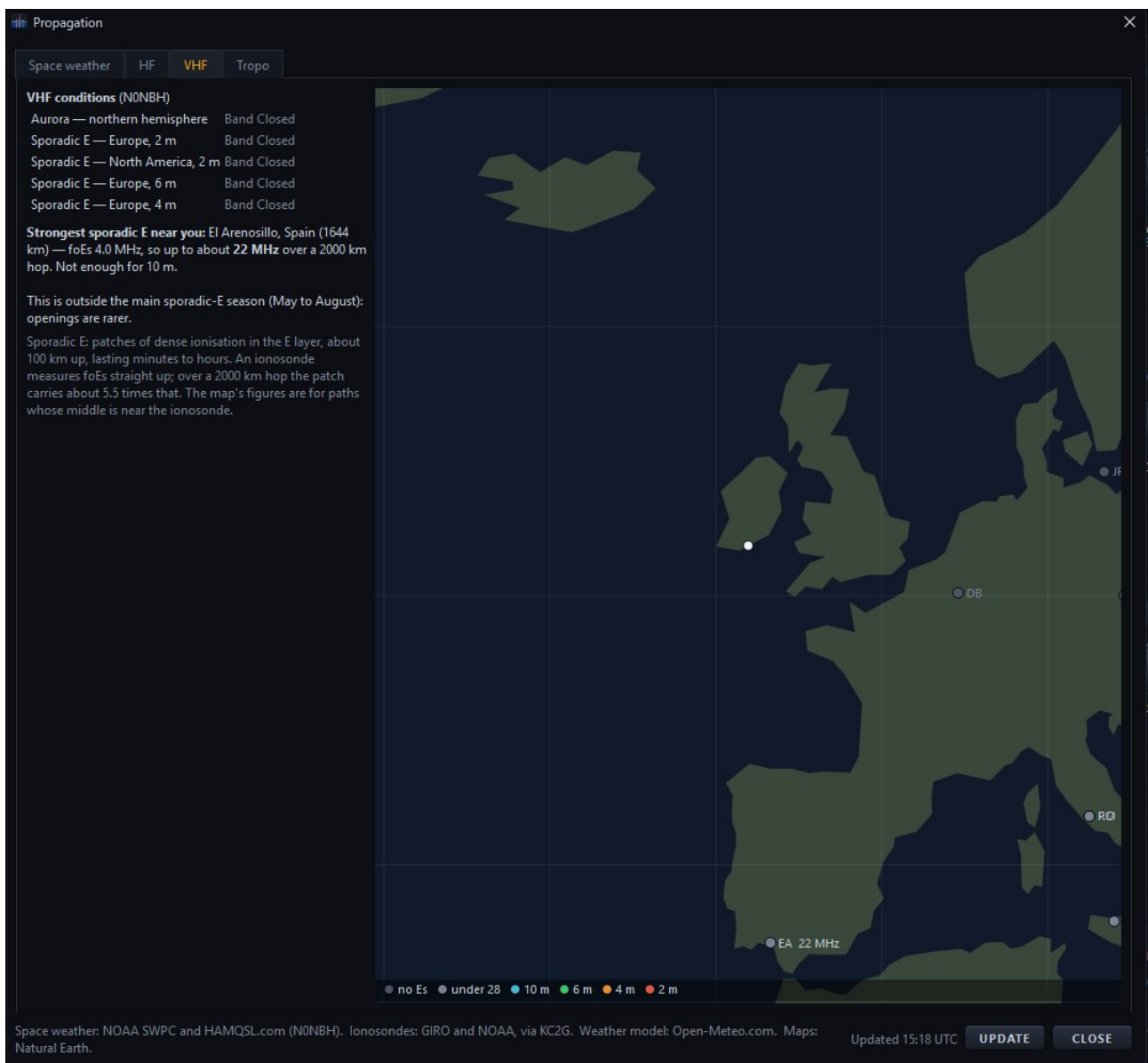
HF



The HF tab: band conditions for day and night, the live ionosondes nearest you, the highest frequency a 3,000 km hop will carry and the best one to use, and the greyline map. The white dot is you.

- **Band conditions:** NONBH's verdict, Poor, Fair or Good, on each pair of bands, by day and by night, with the one for now marked.
- **Ionosondes near you:** live soundings of the ionosphere from the stations nearest you, with how far away each is and how old its reading is. *foF2* is the highest frequency the ionosphere sends straight back down; the *MUF* is the highest it carries over a 3,000 km hop through that point; *foEs* is sporadic E.
- Below the table, from the nearest fresh reading: the MUF, the **best working frequency** (85% of the MUF, the most reliable), and the highest band that one hop is open on.
- The **greyline map:** night shaded, the greyline in lilac, you as a white dot and the sun as a yellow one. Paths along the greyline are often open when nothing else is.

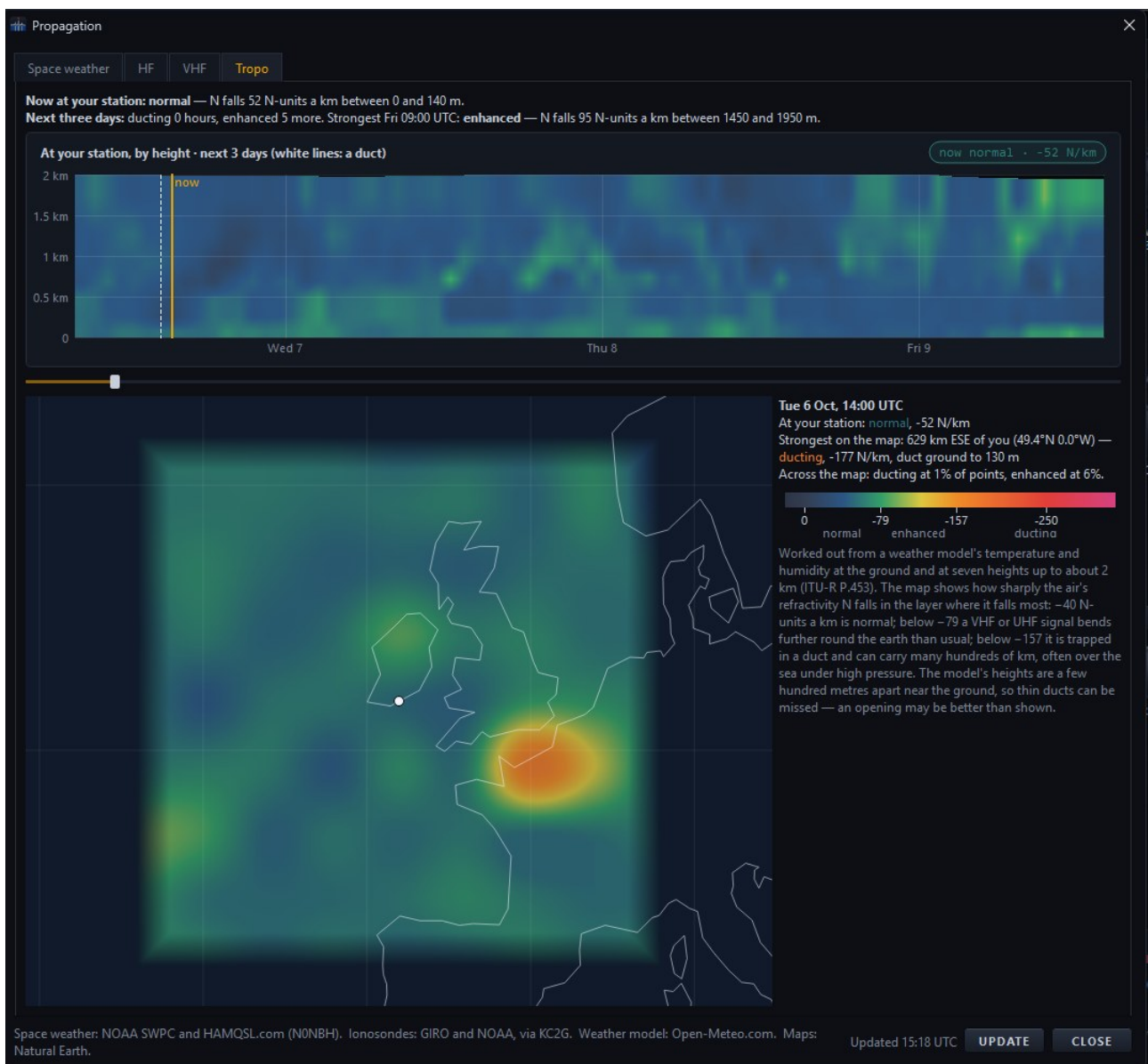
VHF



The VHF tab out of season: N0NBH's aurora and sporadic-E conditions on the left, with the strongest sporadic E near you and what bands it would open. The map shows the ionosondes' sporadic-E readings, coloured by the highest band each would open.

Aurora and sporadic-E conditions from N0NBH, then the strongest sporadic E an ionosonde near you is seeing, with the highest frequency it would carry over a 2,000 km hop and whether that is enough for 10 m, 6 m, 4 m or 2 m. The map shows each ionosonde in colour by the highest band it would open, and the text says whether it is the sporadic-E season.

Tropo



The Tropo tab. The chart at the top shows the next three days at your station, by height, with any ducts as white lines; the slider picks the hour for the map. Here the air is normal over you, while a duct lies over the Channel to the south-east.

Tropospheric ducting is what carries VHF and UHF signals hundreds of kilometres, often over the sea under high pressure. The application works it out, to the ITU's method, from a weather model's temperature and humidity at the ground and at seven heights up to about 2 km:

- The line at the top says what the air is doing over you now, and how many hours of ducting and enhanced conditions the next three days hold, with the strongest.
- The **chart** shows the next three days at your station, by height. Click an hour, or move the slider, to show that hour on the map.
- The **map** shows the area around you, coloured from normal (dark) through enhanced to ducting (red), and the text beside it gives the strongest point on the map and how much of it is ducting.

The model's heights are a few hundred metres apart near the ground, so thin ducts can be missed, and an opening may be better than shown. Space weather comes from NOAA's Space Weather Prediction Center and HAMQSL.com (N0NBH), the ionosondes from GIRO and NOAA by way of KC2G, and the weather model from Open-Meteo.com.

16. Listening: broadcasts, bookmarks and logs

For listening as much as for operating, the **RADIO** menu has a broadcast schedule, bookmarks with a scanner, a listening log, a record of signal strength, and recordings at set times (section 19).

The broadcast schedule

67 broadcasts

Schedule

Summer 2026 schedule (A26) from EIBi: 9,593 broadcasts, downloaded 05/10/2026. UPDATE

Your locator: I051XJ ☐ Name the stations on the bandscope ☒ Keep the schedule up to date (checked once a week)

☐ Mark the broadcast bands on the bandscope ☐ Show channel markers ☐ Show beacons ☐ Name utility stations on the bandscope

Schedule data: EIBi, by Eike Bierwirth — eibispace.de. A schedule says what should be on the air; only what you hear identifies a station.

The broadcast schedule, showing what is on the air now in the 49 m band. Each broadcast shows its frequency, hours, days, mode, station, language, target area, country and transmitter site, with the distance and bearing from you. The settings for the schedule are underneath.

RADIO → **Broadcast schedule** lists the world's shortwave broadcasts. The schedule is EIBi's, by Eike Bierwirth, and **UPDATE** downloads the current season's from eibispace.de; with *Keep the schedule up to date* ticked, it checks once a week.

- **Show** chooses what is *On the air now* or *The whole season*, and the second list a band: all frequencies, around the radio's frequency, LW, MW, or one of the shortwave broadcast bands.
- The search box finds a station, a language or a country.
- **Double-click** a broadcast to tune the radio to it, in its mode. Right-click for more: tune in USB or LSB with the carrier at zero beat (ECSS), bookmark it, or record it once or every day.
- **Your locator** gives the distance and bearing to each transmitter. It is the same locator the macros use.

The ticks underneath put the schedule on the bandscope: **Name the stations**, **Mark the broadcast bands**, the single-letter Morse **channel markers**, **beacons**, and **utility stations** — aero and coast radio, Volmet, HFDL ground stations and the like.

A schedule says what should be on the air; only what you hear identifies a station.

Bookmarks and scanning

RADIO → **Bookmarks** keeps frequencies of your own, each with a name, a mode and, for a data station, the decoder settings. **ADD** bookmarks where the radio is now; you can also right-click the bandscope to bookmark the dial or any frequency on the scope. Double-click a bookmark to tune to it, and click a selected name, or press F2, to rename it. **WEATHER** adds the German weather service's RTTY stations for shipping.

Tick the bookmarks to include, then press **SCAN**: the application steps round them and stops on any that is on the air. **Squelch** is the S-meter level that counts as a signal (set it just above the band's noise),

Listen how long to listen on each before moving on, and **Move on** how long after a signal goes quiet. Turning the dial stops the scan, and so does transmitting.

Going back

Tuning from any of these windows — the schedule, a bookmark, a DX spot, a decoder channel — remembers where the radio was. **BACK** in each window, **RADIO** → **Back**, or **Alt+Left** returns there.

The listening log

RADIO → **Listening log** is a log for what you hear, rather than whom you work. **FROM RADIO** fills in the time, the frequency and mode, the station the schedule has on that frequency now, and the S of the SINPO report from the S-meter; you judge the rest — interference, noise, propagation and overall — and press **SAVE**. **REPORT** puts a reception report for the selected entry on the clipboard, ready to paste into an email to the station, and **EXPORT** writes the whole log as a CSV file for a spreadsheet.

Signal history

RADIO → **Signal history** draws the S-meter over the last 15 minutes, hour, 4, 12 or 24 hours: useful for watching a band open and close, or a station fade. It is kept for 24 hours while the application runs, whether or not the window is open. **SAVE** writes it to a CSV file, one line a second, with the frequency and the average and peak S-meter readings.

17. Data decoders

RADIO → **Data decoders** reads the data signals of the shortwave utility stations: ships, aircraft, military and government stations, and amateur mailboxes. Choose what to decode from the **Mode** list, tune to one of its channels, and press **DECODE**.

Mode	What it reads
Maritime DSC	Digital Selective Calling: ships and coast stations calling each other, distress alerts and their acknowledgements.
ALE (MIL-STD-188-141)	Automatic Link Establishment: the warbling bursts of military, government and amateur stations sounding and calling.
Aircraft HF DL	HF Data Link: airliners over the oceans and the poles and their ground stations — ACARS messages, position reports and logons.
SELCAL (aircraft calls)	The two-tone calls ground stations send to raise one aircraft on the HF voice channels.
PACTOR	Mailboxes, Winlink and ships' email: who is calling whom, PACTOR-I links read in full, and links that move up to PACTOR-II, III or 4 named.
Military modems (identify)	STANAG 4285 and MIL-STD-188-110A modems: which one, and its rate and interleaving where the signal says. What they carry is not decoded.
Identify a signal	Measures whatever is in the passband — width, tones, shift, speed, keying — and compares it with the known HF modes.
NAVTEX..., Weather fax..., Aircraft map...	Each opens a window of its own (below).

The screenshot shows the 'Data decoders' application window. The 'Mode' is set to 'Maritime DSC'. A list of channels is on the left, with '8414.5 distress and safety' selected. The main area displays a table of received calls. The selected call is expanded, showing details like 'Received: 2026-10-05 14:44:51 UTC', 'Format: Individual call', 'To: 356037000 (Panama)', 'Category: Safety', 'From: 002371000 (coast station, Greece)', and 'Telecommand 1: Test'. The bottom of the window shows the file path for saved messages and a 'CLOSE' button.

UTC	Mode	Kind	From	Summary
14:47:18	DSC	Test	002371000 (coast station, Greece)	Individual call to 238021000 (Croatia) from 002371000 (coast station, Greece): Test, 8291.0 kHz (acknowledge...
14:46:54	DSC	Test	374275000 (Panama)	Individual call to 002630100 (coast station, Portugal) from 374275000 (Panama): Test (acknowledgement ...
14:44:51	DSC	Test	002371000 (coast station, Greece)	Individual call to 356037000 (Panama) from 002371000 (coast station, Greece): Test, 8291.0 kHz (acknowl...
14:43:39	DSC	Test	356037000 (Panama)	Individual call to 002371000 (coast station, Greece) from 356037000 (Panama): Test (acknowledgement r...

```

Received: 2026-10-05 14:44:51 UTC
Format: Individual call
To: 356037000 (Panama)
Category: Safety
From: 002371000 (coast station, Greece)
Telecommand 1: Test
Telecommand 2: No information
Their receive frequency: 8291.0 kHz
Their transmit frequency: 8291.0 kHz
Acknowledgement
Check character: correct
1 character(s) taken from their second copy
Symbols: 120 120 35 60 37 0 0 108 0 23 71 0 0 118 126 8 29 10 8 29 10 122 12
  
```

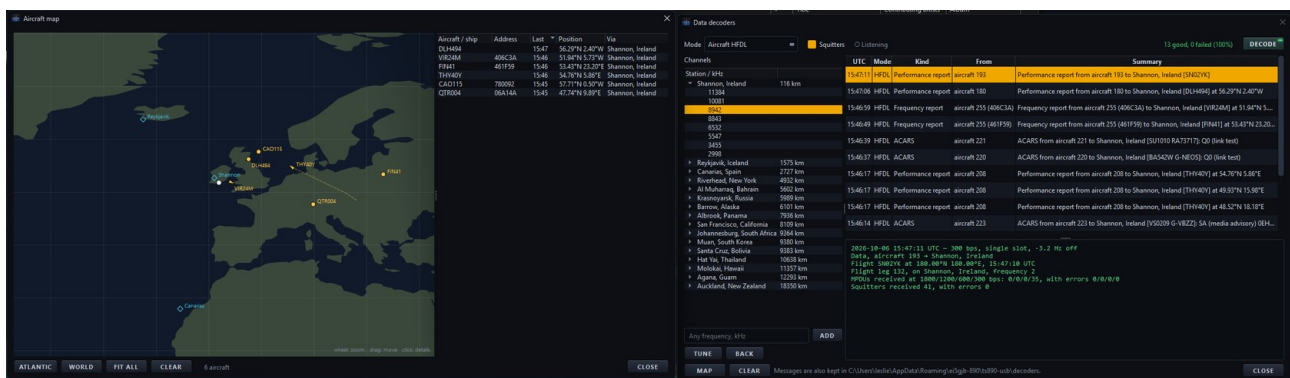
Maritime DSC on 8414.5 kHz. The channels are on the left, the calls received on the right, and the selected call in full underneath: a safety test call from a Greek coast station to a ship, with its acknowledgement.

Using the window

- **Channels** lists the frequencies for the mode: the distress and safety channels for DSC, the HF DL ground stations with each one's frequencies and distance, the mailbox bands for PACTOR, and so on. Double-click one to tune to it; **TUNE** does the same for the selected one, in USB with the signal in the middle of the audio. Type any frequency in the box underneath and press Enter to go there, or **ADD** to keep it under *Your channels*.
- Each message is a row: the time, the mode, the kind, who sent it and a summary. Click one to see it in full underneath.
- The figures at the top right count the frames read and the frames that failed their check. On HF a fair share always fail, to fading and to two stations transmitting at once; the failed ones are not shown.
- **CLEAR** empties the list and starts the decoder afresh. **BACK** returns the radio to where it was.
- Every message is also kept in monthly files, in the *decoders* folder beside the settings file; the line at the bottom gives the folder.

Every mode here is received in USB. The window warns you if the radio is in another mode, if the receive filter cuts off part of the signal, or if NR4 is feeding the decoders, which upsets the phase some modes are read from.

HF DL and the aircraft map



HF DL from Shannon on 8942 kHz. On the right, the messages: performance and frequency reports and ACARS from aircraft over the Atlantic. On the left, the aircraft map with each aircraft's position and track, and the ground stations as blue diamonds.

Airliners over the oceans report their position over HF DL, so the decoder can show where they are.

MAP, or *Aircraft map*... in the Mode list, opens the map: each aircraft with its flight number and track, the ground stations, and any ship in distress heard on DSC. The list beside it gives each one's address, when it was last heard, its position and the ground station it was talking to. **ATLANTIC**, **WORLD** and **FIT ALL** choose the view; the wheel zooms, dragging moves the map, and a click gives the details.

Tick **Squitters** to list the ground stations' own short broadcasts too; each station sends one on every frequency it has up, every 32 seconds, so they are a quick way to find out which frequencies are in use.

For SELCAL there is no position to show, since the call is only two tones. Right-click a SELCAL call to note which aircraft it is — a flight or registration heard in the voice call that follows — and it is shown with the code from then on, and on the map once HF DL places that aircraft. *SELCAL code book*... lists your notes.

NAVTEX

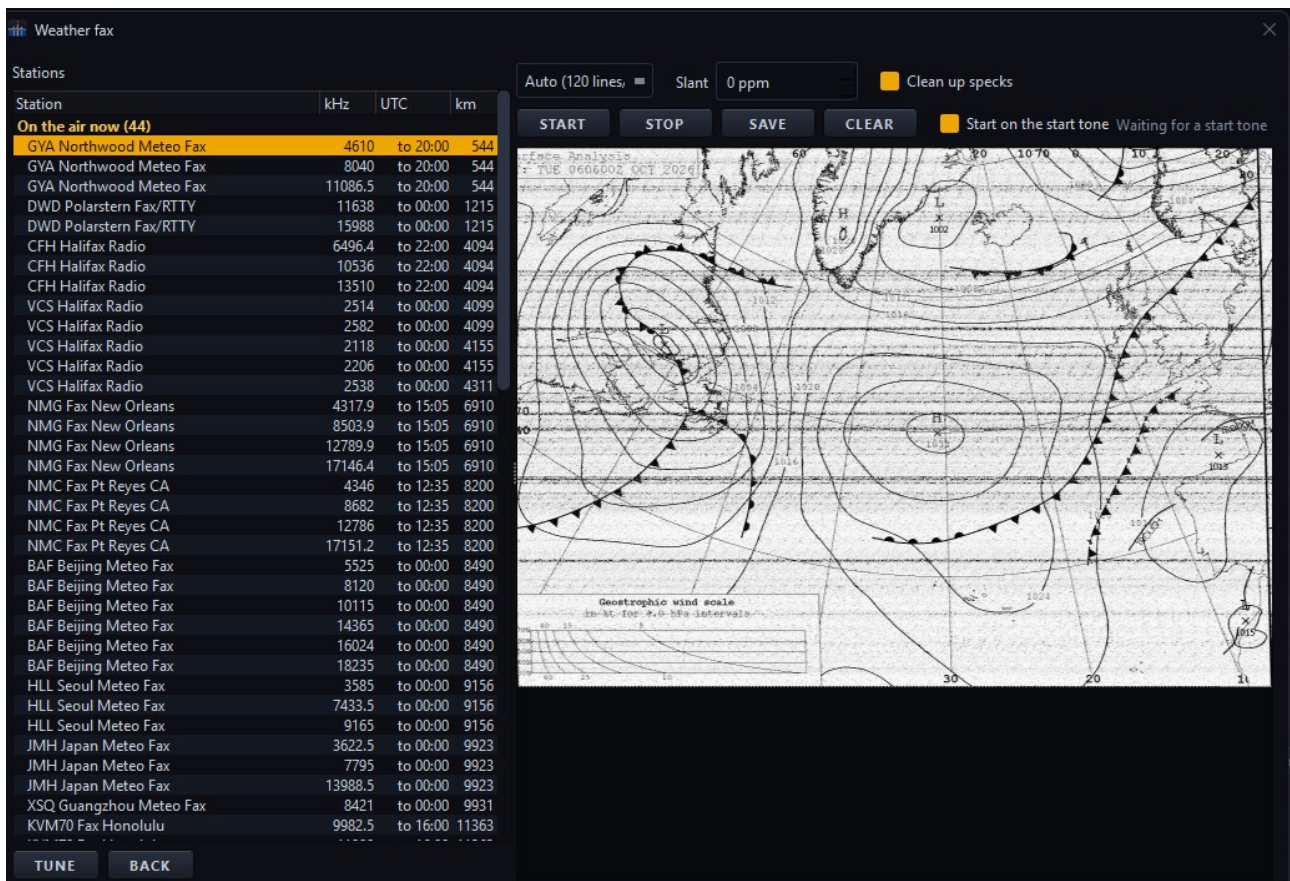


NAVTEX on 4209.5 kHz, locked on, with 92% of characters confirmed. Two navigational warnings from Istanbul are listed, and the selected one is shown in full underneath.

NAVTEX carries the maritime safety broadcasts: navigational warnings, weather forecasts, and search and rescue. The three keys tune to its frequencies, **518 kHz**, **490 kHz** and **4209.5 kHz**, in USB. **Centre** is where the signal sits in the audio; the decoder finds it within 150 Hz of that. The line beside DECODE says whether it is locked on, and what share of the characters it is sure of.

Messages lists each message with its time, station, type and number, and shows the selected one in full; **As received** shows everything as it came in. A message that was not received to its end is marked *cut short*. Messages are also kept in the *navtex* folder beside the settings file.

Weather fax



A surface analysis chart from Northwood, received on 4610 kHz. On the left are the fax stations on the air now, nearest first.

Weather charts are still sent to ships by radio fax, and the window draws them line by line as they arrive.

- **Stations** lists every fax station in the broadcast schedule, nearest first, with those on the air now at the top. Double-click one, or press **TUNE**, to tune to it: the dial goes 1.9 kHz below the listed frequency, in USB.
- With **Start on the start tone** ticked, a chart starts by itself when the station sends its start signal. **START** starts one now, and **STOP** stops it.
- The lines-per-minute setting is normally **Auto**, which finds the rate from the chart itself and starts at 120, the rate most stations use.
- **Slant** corrects for the sound card's clock: a chart leaning to the right wants a higher number, one leaning to the left a lower one. It holds for this computer, so it only needs setting once. If the chart is shifted sideways, click where its left edge should be.
- **Clean up specks** takes out lone specks of noise and leaves thin lines and lettering alone.
- **SAVE** saves the chart as a picture, and a chart that ends by itself is saved by itself, in the *TS-890S fax* folder in your Pictures folder. **CLEAR** empties the picture without saving it.

18. The radio's own menu

MENU on the panel opens the radio's settings over CAT. The categories run along the top as keys; every row shows the radio's own menu number (6-11, 7-10 and so on) so you can find the one somebody told you to change.

The **FIND** box searches names, descriptions, menu numbers and the values themselves — typing *115200* finds the baud rate. Every word you type has to appear somewhere in the row, in any order.

This window carries about a quarter of the radio's settings — the ones that matter for operating and for this application. The status line says how many. For anything not listed, use the radio's own menu.

The KNS page

The last key along the top is **KNS**: the radio's network settings — whether it answers network control at all, the built-in VoIP, the session time, the access log and the welcome message. These are not menu items and they have no menu number; they travel over the LAN link, so the page is empty unless that link is connected.

You can read them from any account, but changing any one of them needs the Administrator login — set that in Connections. With a User account the radio simply refuses the change. Changing the administrator password and managing the user list are not done here; they stay on the radio's own screen.

19. Recording

The recorder pane records what you are hearing, plays it back through the computer, and can put a recording on the air. Files are named and listed, and the folder is set in Connections.

Recording at set times

RADIO → **Recording schedule** records a frequency at a time you choose, once or every day — a broadcast you want to hear later, or a band at the time it usually opens. **ADD** makes a job for where the radio is now, from the next hour, for 30 minutes; click a selected cell to change its name, frequency, mode, date (or *daily*), start time in UTC, or length in minutes. In the Broadcast schedule, right-click a broadcast and choose *Record this broadcast* or *Record it every day* to make the job for you.

The application has to be running, and the radio connected, when a job is due. A job is skipped, and the log says so, if the radio is not connected or is transmitting at the time. The line at the bottom of the window says what is next. Recordings go to the recorder's folder.

20. Power

The **POWER** key at the top left switches the radio on and off. Switching a TS-890S on over USB is not a single command: the radio's processor is asleep and has to be woken with dummy data first, then given a moment, then told to power up. The application does all that for you.

21. Where your settings live

Everything the application remembers — layouts, band stacks, display choices, connection details, alert settings, the plugin chains and their settings — is kept in a small database file:

```
%APPDATA%\ei5gjb-890\ts890-usb\ts890-usb.db
```

On a Mac it is:

```
~/Library/Application Support/ei5gjb-890/ts890-usb/ts890-usb.db
```

The logbook is in the same file, along with the PSK map's history and the contest calendar. Copy it to move your setup, and your QSOs, to another computer. Nothing about your radio is sent anywhere.

Beside it, in the same folder, are the *decoders* and *navtex* folders, where the data decoders keep their messages. Weather fax charts go to *TS-890S fax* in your Pictures folder.

Your logins — the radio's network login, QRZ.com, LoTW and Club Log — are not in the settings file. They are kept by Windows, encrypted for your Windows account, under Credential Manager in Control Panel, or on a Mac in your Keychain, so they do not move with the file: type them in again on a new computer.

Backups

Once a day the application makes a copy of that file, with your settings and your whole logbook in it, in a *backups* folder beside it. The newest ten are kept and older ones are deleted, so the folder does not keep growing. Each copy is named after the date and time it was made, for example *ts890-usb-20261011-140512-123.db*.

The copy is made in the background while you carry on: the radio, the bandscope and the audio are not held up. A copy is never half written: it is given its name only once it is complete. The log says when each one is made.

In the RADIO menu	What it does
Back up settings and logbook now	Makes a copy straight away: before a big import, for example, or before you try something new.
Open the backups folder	Shows the folder, so you can copy a backup somewhere safe, such as a USB stick or another computer.

To restore a backup:

- Close the application.
- Open the settings folder (the path at the top of this section). Rename *ts890-usb.db* to something like *ts890-usb-old.db*, so you can go back to it.
- If *ts890-usb.db-wal* and *ts890-usb.db-shm* are there, delete them.
- Copy the backup you want from the *backups* folder into the settings folder, and rename the copy *ts890-usb.db*.
- Start the application. It opens with the settings and the logbook as they were when that backup was made.

A backup holds the settings and logbook only. Your logins — the radio's network login, QRZ.com, LoTW and Club Log — are not in it: Windows (or the Mac's Keychain) keeps them, as described above. QSOs made after the backup will not be in the restored logbook. If your logging program still has them, the logger link reads them back in.

22. If something is not working

Symptom	Most likely cause
Nothing connects	Press Find radio in Connections. It finds the right port, and says if the port is in use by another program or menu 7-00 is not 115200.
The frequency stays blank, but the bandscope and audio work	The app is on the radio's second port, which never answers. The bandscope comes over the network and the audio over the sound device, so they still work. Press Find radio .

"in use by another program"	Something else has the radio's port open — often a logger set to the radio's COM port, or Kenwood's ARCP-890. Close it, or point the logger at the TCI server. The app connects by itself once it's free.
Keys or knobs are slow to reach the radio	They should reach it at once. If not, open the CAT log: a line such as "AG120 waited 800 ms for the radio link" shows the link is struggling. Copy the log when reporting it.
The log says "The app was held up for ..."	Something kept the application busy for a moment, and the controls would have felt slow then. The line names the window that was in front, which is usually the cause. One now and then is nothing to worry about; if they come often, copy the log when reporting it.
The log says "Transmit safety: ..."	The application stopped responding for more than three seconds while transmitting, so it sent the radio back to receive. Check the radio is on receive, then report it with the log.
The bandscope is slow or empty	Read what the empty scope says — it names the reason: no IP address entered, the USB CAT port not connected, the source set to Off, or a login that worked with no sweeps arriving (the rig is off, or its bandscope display is). Otherwise check the IP address and the KNS user name and password in Connections.
No audio scope, no decoding	No receive audio device chosen in Connections, or Windows has the radio's audio muted.
I cannot hear the radio through the PC	Tick Listen in Connections and pick an output. Ticking the codec on in Windows is not enough by itself.
Listen is on and still silent	Watch Level in. Flat means the radio is not sending audio down the USB port — menu 7-08.
Decoding is poor and the audio sounds distorted	Look at the clip flag on Level in. If it is lit, turn menu 7-08 or Trim in down until it stops.
NR4 makes no difference	It only changes what this computer plays. Tick Listen in Connections; on the radio's own speaker it cannot help.
NR4 switched itself off	It could not keep up and said so rather than freezing the window. Lower the Threshold in its dialog.
The audio scope is empty while transmitting	The radio's TX monitor is off, or is not routed to the rear connectors — menu 7-10.
RTTY or PSK transmits but nobody hears it	Check that a transmit audio device is chosen in Connections, and that the ALC moves while sending. Watch the log: from FSK, PSK, LSB or USB it should say the radio went to LSB-D or USB-D for the over.
RTTY or PSK31 is not sent at all	The log says why. Sending from FSK, PSK, LSB or USB needs the dial moved for the over, so it is refused with LOCK on, on a memory channel, and in split. Release LOCK, use a VFO, or put the radio in LSB-D or USB-D.

QSOs do not reach Log4OM	Log4OM is not running, or listens somewhere else: check its INCOMING JT MESSAGE connection is enabled on port 2237, and that its SAVE_NEW_QSO setting is on. The lamp beside LOGGER LINK, and the pointer resting on it, say what the link last did.
A QSO I deleted keeps coming back	It is still in your logging program's log, which is read back here. Delete it there as well.
The Log QSO window shows no photo or locator	QRZ.com sends them only to XML Data subscribers; the card says so. In a contest, QRZ.com is not asked at all.
The distance to a station looks wrong	Read the line under it: it names the locator it was measured to. A four-character locator, or an old one from your log, can be well out. Check your own locator under EDIT in the macros too.
LoTW: "TQSL is not installed"	Install TQSL from the ARRL's LoTW pages, set up your certificate and a Station Location in it, or show the application where TQSL is with TQSL....
The PSK map is empty	Only digital modes are reported. Transmit FT8, FT4 or WSPR, and look again in five minutes. Check your callsign under EDIT in the macros.
The DX cluster shows no spots	Check SOURCES: a source must be switched on, and a telnet node needs your callsign. If Spothole cannot be reached, a standby node takes over after two minutes.
A data decoder never decodes anything	Read the warning at the top of the window: the radio must be in USB, the receive filter wide enough, and NR4 not feeding the decoders. Then check the channel is in use: try another.
MIC does nothing	Mic in is not ticked in Connections, or no Audio out device is set. The log says which.
FreeDV never shows SYNC	Check both stations are in the same mode and on the same sideband: if a station you can see never syncs, try the other sideband. Then check the signal sits on the green DV mark and the radio's noise reduction is off.
FreeDV decodes but I hear nothing	Tick Listen in Connections.
FreeDV Reporter says it lost the connection	It tries again by itself, waiting a little longer each time. Check the computer can reach qso.freedom.org.
A plugin makes everything silent	Its trial has run out, or it is not licensed on this computer. The plugins window warns you; open the plugin's own window to see what it wants (section 10).
A plugin has gone from the chain	It crashed, and was taken out so the rest could carry on. The log says which one and when. Add it again to try once more.
The Listen plugins say no audio is coming in	Listen is not ticked in Connections. The Listen chain only works on what this computer plays.
The dial moves the wrong VFO	The VFO B key beside the step keys is lit.

A setting is missing from the MENU window

That window carries about a quarter of the radio's settings. Use the radio's own menu.

Transmit safety

The radio should never be left transmitting because the application has stopped. Two things look after that:

- **If the application stops responding** for more than three seconds while you are transmitting — from the microphone, a tune tone, FreeDV or a digital mode — a separate part of it that keeps running sends the radio to receive. It does this once, and the log says so in red.
- **If the application crashes** while transmitting, it sends the radio to receive on its way out.

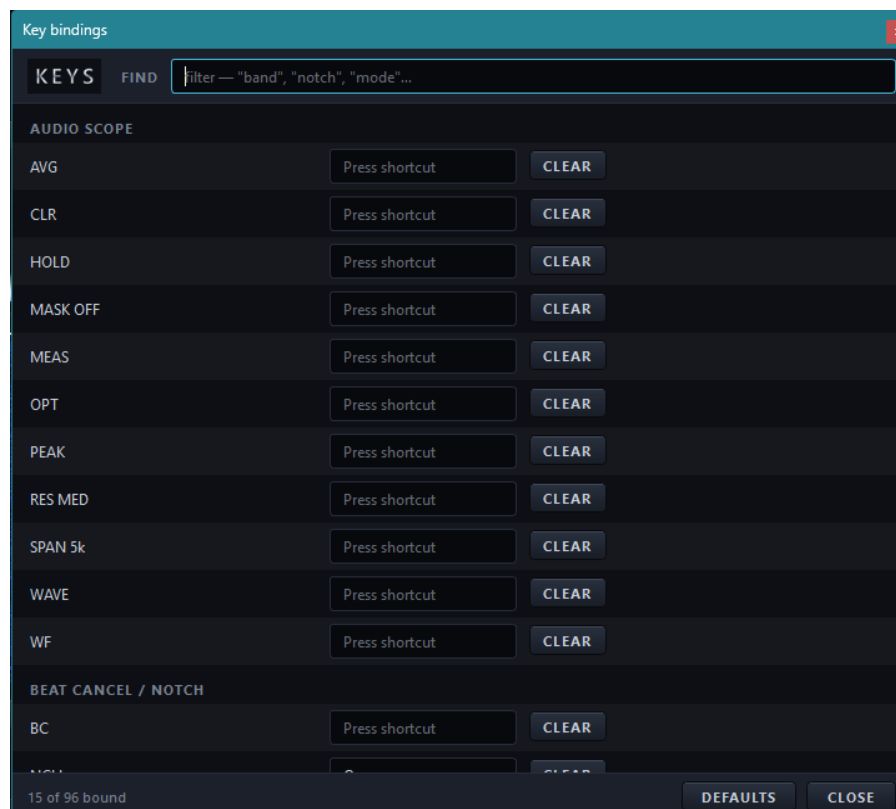
Both write straight to the radio's USB port, or to its network connection when you are remote, so they still work when the rest of the application cannot. Short hold-ups are logged as well, in amber, with the window that was in front at the time; they help track down anything that makes the controls feel slow.

The CAT log

The log pane shows what is going over the wire. By default it hides the routine polling so you can see your own commands; there is a switch to show everything. If you ever need to report a problem, this is the thing to copy.

23. Keyboard shortcuts

Every key on every cluster can be put on the keyboard. Open **RADIO** → **Key bindings** (or press **Ctrl+I**), find the one you want in the FIND box, click the key field and press the key you want it on. It takes effect at once, and CLEAR takes it off again. If two entries end up sharing a key, both rows say so.



Key bindings. Type in FIND to narrow the list; the count of bound keys is at the bottom left.

What is bound out of the box

Key	What it does
N	NR — the radio's own noise reduction, off / NR1 / NR2
R	NR4 — noise reduction in this application
B	NB1 — noise blanker
G	AGC — fast / mid / slow
O	NCH — notch
T	ATT — attenuator
P	PRE — pre-amplifier
A	ANT — antenna socket
V	A/B — swap the VFOs
X	VFO B — point the dial at B
S	SPLIT
D	DECODE

Plain letters, because a shortcut you need a modifier for is barely faster than the mouse. They are suspended automatically while the cursor is in anything you can type into — a FIND box, a callsign field, the decode pane's send line — so they never eat your typing.

Not bound, on purpose

SEND and **POWER** start with no key. A stray press that puts RF into the antenna, or switches the radio off mid-contact, is not something to hand out by default. Both are in the list if you want them.

The fixed ones

Keys	What it does
Ctrl+/	Key bindings
Ctrl+K	Connections
Ctrl+L	Log a QSO — open one, or save the open one
Alt+Left	Back to where the radio was before the last jump
Ctrl+M	The radio's own menu
Ctrl+E	Arrange panel on and off
Ctrl+Shift+E	Tidy up the clusters
Ctrl+Shift+S	Save the current layout under a name
Shift + wheel	Tune in tenths of the step size

Ctrl + wheel over the bandscope	Change the scope span
------------------------------------	-----------------------

Shift + drag on the audio scope	Measure the power in a span
---------------------------------	-----------------------------

24. Remote operation: your radio from somewhere else

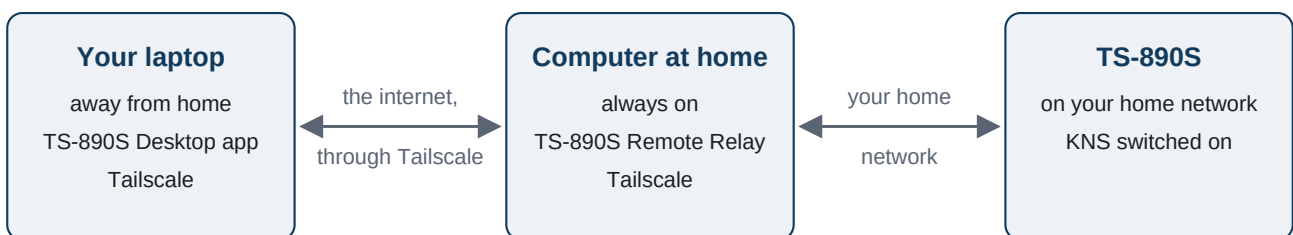
Remote operation lets you use the radio from another computer — a laptop in another room, or one at the other end of the country — with the same front panel, bandscope, meters and audio as at home. You listen through the laptop, talk through its microphone or headset, and work the panel exactly as you would sitting at the radio.

Remote operation is new and marked **experimental**. It has been used from home Wi-Fi and from a phone's mobile data. Try it into a dummy load before you rely on it on the air.

How it works

At home, the application talks to the radio over its USB cable. The radio also has a network port of its own, and Kenwood built it so the radio can be controlled through it: this is the radio's **KNS** (Kenwood Network Command System). Over KNS the radio takes its commands, sends its bandscope, sends its receive audio and takes transmit audio — everything the USB cable does. Remote operation uses that instead of the cable.

Inside your own house that is all there is to it: the laptop connects to the radio's network port over Wi-Fi. From outside the house, two more pieces are needed, and the picture shows where they sit.



Operating from away from home. Tailscale joins the laptop and the computer at home over the internet; the Remote Relay on that computer passes everything on to the radio and back.

- **Tailscale** is a free program that makes your laptop and your computer at home behave as if they were on the same network, wherever the laptop is. Everything between them is encrypted, and nothing on your home router has to be opened to the internet.
- The **TS-890S Remote Relay** is a small program that comes with this application. It runs on the computer at home and passes everything between the laptop and the radio.

Why the Remote Relay is needed

You might expect Tailscale alone to be enough, and for the controls it is. The difference is in how the radio sends its audio.

- The **controls** work like a phone call that the laptop makes: the laptop rings the radio, and the radio answers on the same line. The answer always finds its way back, however many networks are in between.
- The **audio** works like the radio posting letters to a fixed address: the radio sends it, unasked, to the computer it believes it is talking to. From outside the house the radio does not see your laptop — it sees the computer at home that let the laptop in — so the audio goes there and stops.

That is exactly what happens without the relay: from outside, the frequency, the meters and the bandscope all work, and there is no sound. The relay is the computer the radio is really talking to. It receives the radio's audio on your home network, where it always arrives, and sends it on to the laptop, and it takes the laptop's transmit audio and hands it to the radio. Kenwood's own remote software for this radio works the same way: a program on a PC at the station passes everything to the one away from it.

What the Remote Relay does

- It waits for a laptop to connect. Until one does, it leaves the radio alone.
- When a laptop connects, it opens the radio's network session and passes everything through both ways: the login, the controls, the bandscope, the receive audio and the transmit audio. It changes nothing on the way, unless you ask it for **low data** (below).
- The radio still checks your KNS user name and password itself. The relay only carries them; it does not know them and does not store them.
- One laptop at a time, because the radio allows one network session. A second laptop is told the radio is busy.
- When the laptop disconnects, the relay closes the radio's session, so the computer at home can use the radio again.
- **If the laptop's connection is lost** — the mobile signal drops, the lid is closed — the laptop can no longer tell the radio to stop transmitting. The relay can, because it is still on your home network: it sends the radio to **receive** before it lets go, whatever the radio was doing.
- It does not wait for the connection to close, which on a dead mobile link can take minutes. While the radio is transmitting, the application sends the relay a short sign of life every second; **if nothing arrives for four seconds**, the relay sends the radio to receive.
- **No transmission may last longer than ten minutes** through the relay: past that it sends the radio to receive, in case a key is stuck down at the far end. The radio's own transmit time-out still applies as well.

When the relay has sent the radio to receive by itself, the application says so in its log and status bar, with the reason.

Its window shows what it is doing: when a laptop connects and leaves, and every half minute how much audio it has passed each way. It also keeps the same lines in a file, *kns-relay.log*, beside it.

New in version 2.4: update the relay at home too

The Remote Relay that came with version 2.3.0 passed everything through and sent the radio to receive when the laptop's connection closed, and that was all. The relay in version 2.4 does a good deal more, and the application on the laptop makes use of it, so **update the relay at home as well as the application on the laptop**.

	Relay from version 2.3.0	Relay from version 2.4
Connection lost while transmitting	Receive once the connection is seen to close — on a dead mobile link that can take minutes.	Receive after four seconds without a sign of life from the laptop (ten seconds with an older application, which sends none).
A transmission that goes on and on	No limit.	Receive after ten minutes without a break; change it with <code>--tx-limit</code> .
Low data, for a phone or hotspot	Not there.	Compressed audio and a slower bandscope: about 50 MB an hour instead of about 250.
Link quality on the laptop	No ping.	Answers the application's ping, so the status bar shows the round trip (see <i>Watching the link</i> below).
Its own address given as the radio's	Accepted, then every laptop was turned away as “busy”.	Refused at the start, with the reason and an example of the right address. The Pi installer also warns about a Tailscale address.
Running the Pi installer again	Left the old relay running.	Restarts the relay, so a new version or a new radio address takes effect at once.

Updating it. On a Windows PC the relay comes with the application: close the relay's window, install version 2.4 on that PC, and start the relay again from the Start menu. On a Raspberry Pi, copy the version 2.4 package to it and run the same three lines as when you first installed it (see *The relay on a Raspberry Pi* below). The installer replaces the relay and restarts it, keeping it starting at every boot. If you had changed the transmit limit with `--tx-limit`, set it again afterwards: the installer writes the relay's settings afresh. On the Pi, `journalctl -u kms-relay -b` then starts with a line giving the *Longest transmission*, which the old relay never printed.

How to tell the relay is still the old one. The laptop's log never says *Remote: through the relay* after connecting; the line under Low data says you are connected straight to the radio although Host is the relay's address; and the link readout in the status bar shows no ping. Sound and the controls still work, but without the new safety checks.

What you need

Where	What
The radio	On your home network, with KNS switched on and its built-in VoIP on, and a KNS user name and password. These are on the radio's KNS settings, which this application shows on the KNS page of the radio's menu (section 18).

At home	One computer that stays switched on while you are away, with Tailscale and the TS-890S Remote Relay running: the shack PC, or a Raspberry Pi , which uses far less power (see “The relay on a Raspberry Pi” below). It must not go to sleep.
Away	A laptop with this application and Tailscale , signed in to the same Tailscale account as the computer at home.
In between	An internet connection. Receiving everything at full quality takes about 0.6 Mbit/s down, about 250 MB an hour; transmitting adds about 0.3 Mbit/s up. Home broadband and most mobile data manage that easily. On a phone's data allowance, low data (below) cuts it to about 50 MB an hour.

Setting it up

1. Tailscale, on both computers. Download it from tailscale.com, install it on the computer at home and on the laptop, and sign in to the same account on both. Each computer is given an address beginning **100**. — you will need the one for the computer at home. Tailscale shows it when you click its icon by the clock.

2. The Remote Relay, on the computer at home. This is for a Windows PC; for a Raspberry Pi, see “The relay on a Raspberry Pi” below, then carry on at step 3. Close the TS-890S Desktop application on that computer first: the radio has one network session, and while you are away the relay needs it. Then start **TS-890S Remote Relay** from the Start menu. It finds the radio's address in this application's settings on that computer. The first time, Windows asks whether to let it use the network: allow it on **private networks**.

The installer can start the relay by itself every time Windows starts: tick *Start the TS-890S Remote Relay when Windows starts* when you install. It then opens minimised at every login.

The relay on Windows, day to day. It only runs while its window is open; closed, it does nothing and uses nothing.

To	Do this
stop it now	Close its window (or press Ctrl+C in it). If a laptop is connected, it sends the radio to receive first.
start it	Start menu → TS-890S Remote Relay .
stop it starting with Windows	Task Manager → Startup apps , choose <i>TS-890S Remote Relay</i> , Disable . Or run the installer again with the tick box clear.
have it start with Windows again	The same place, Enable ; or run the installer again and tick the box.
remove it	It is part of the application, so it goes when the application is uninstalled (Settings → Apps). Left switched off it costs nothing, and the Start menu entry is there if you want it again.

3. The application, on the laptop. Open **RADIO** → **Connections** and set:

- On the **Radio** page, **Connect over**: *Network — remote operation (experimental)*.
- On the **Network** page, now headed **Network — radio or relay**: **Host** is the **100**. address of the computer at home. **User** and **Password** are your KNS ones, and tick **Administrator account** if that is the kind it is.

- On the **Audio** page, tick **Audio in** — it now reads *From the radio, over the network* — and tick **Listen**, choosing the laptop's speakers or headset.
- For transmitting, on the **Microphone** page tick **Mic in** and pick the laptop's microphone, as in section 9.
- Back on the **Radio** page, press **Connect**. The **Radio** lamp at the top turns green.

Within a few seconds the panel comes alive and you hear the radio. The relay's window says the laptop has connected.

At home, on your own Wi-Fi, you can leave the relay out: put the **radio's own address** in **Host** instead, and the laptop talks to the radio directly.

On a phone or hotspot: low data

Full quality uses about 250 MB an hour, which eats into a phone's data allowance quickly. On the **Network** page of Connections, tick **Low data (phone or hotspot) — through the relay**. The relay then sends the receive audio compressed (Opus, about 40 kbit/s instead of about 270) and the bandscope five times a second instead of twenty: about 50 MB an hour. The waterfall moves more slowly; everything else works as before. Transmit audio and the controls are not changed.

Low data is for listening and voice. Compressed audio can cost decodes in FT8 and the other data modes, so leave it off for those. It can be ticked and cleared while connected; the log says when the relay has taken it.

The transmit limit. Ten minutes, unless you set it. To change it, start the relay with `--tx-limit` and the number of minutes (0 for no limit): on Windows, add it to the end of the *Target* in the Start menu shortcut's **Properties**; on a Raspberry Pi, run `sudo systemctl edit --full kns-relay`, add it to the end of the `ExecStart` line, save, and run `sudo systemctl restart kns-relay`.

The relay on a Raspberry Pi

A Raspberry Pi does the relay's job just as well as a PC, and uses a few watts instead of leaving a whole computer on. It sits on your home network next to the radio, starts the relay by itself every time it is switched on, and needs no screen or keyboard once it is set up.

You need	
The Pi	A Raspberry Pi 2 or later — a Pi 3, 4 or 5, or a Pi Zero 2 W. The very first Pi Zero and the Pi 1 are too old.
Its software	Raspberry Pi OS, 32-bit or 64-bit; the installer works out which.
Its network	Your home network, the same one as the radio. A cable is steadier than Wi-Fi if you have the choice.
Tailscale	On the Pi, signed in to the same account as the laptop. On the Pi, <code>curl -fsSL https://tailscale.com/install.sh sh</code> installs it and <code>sudo tailscale up</code> signs it in.
The package	TS-890S-Remote-Relay-raspberry-pi.tar.gz , from the same release page as the application.

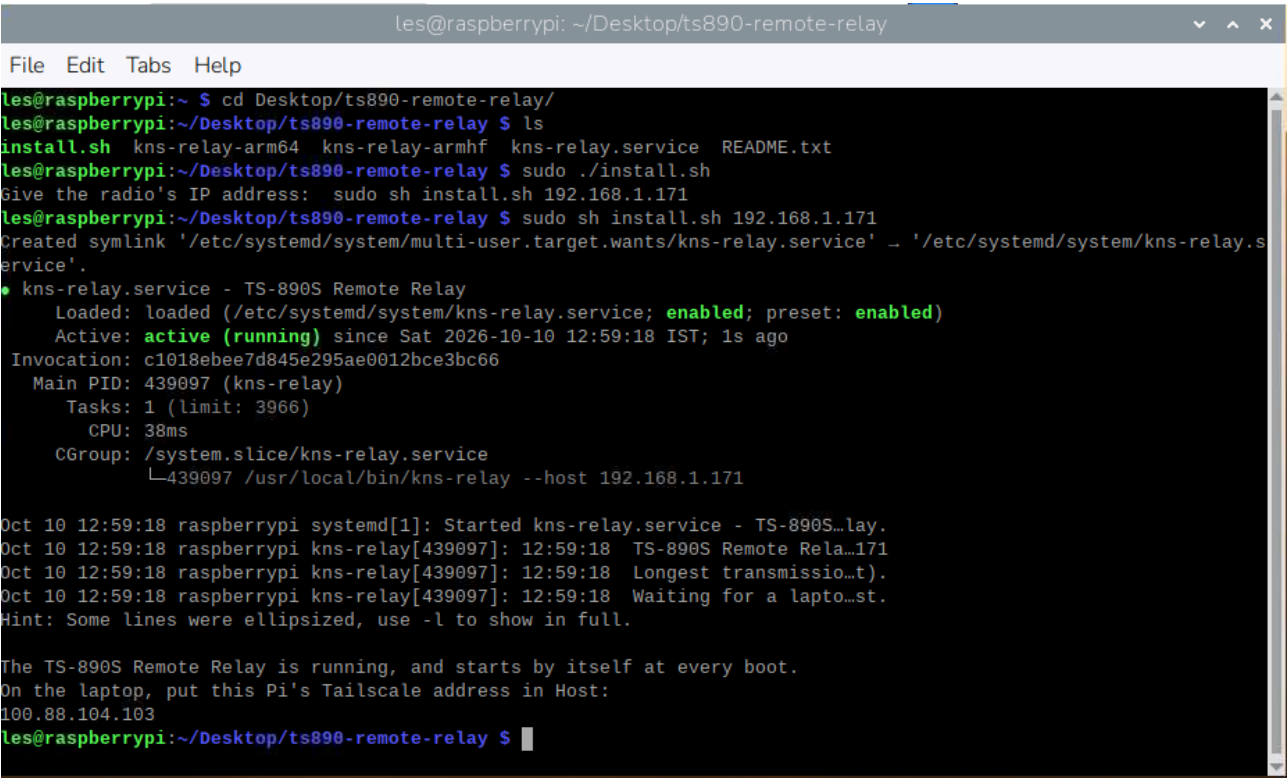
Installing it. Copy the package to the Pi — with **Send with Tailscale** from the right-click menu on Windows, or with scp — then on the Pi, in the folder it landed in, type these three lines, using your radio's address in the last one:

```
tar xzf TS-890S-Remote-Relay-raspberry-pi.tar.gz

cd ts890-remote-relay

sudo sh install.sh 192.168.1.171
```

The relay starts straight away, and from then on every time the Pi starts; if it ever stops, it starts itself again. The last lines on the screen show the Pi's Tailscale address, beginning **100.:** that is the address to put in **Host** on the laptop (step 3 above). If the radio's address changes, run the last line again with the new one.



Installing the relay on a Raspberry Pi. Run without the radio's address, install.sh says what it needs; run again with it, it installs the service, shows it *active (running)*, and ends with the Pi's Tailscale address to put in Host on the laptop.

Use one relay at a time. If you move from the PC's relay to the Pi's, close the one on the PC and take its “start with Windows” tick away, so the two are never both waiting for the laptop.

Day to day. The relay runs quietly in the background as a service called `kns - relay`. These are the commands for it, typed on the Pi:

To	Type
see whether it is running	<code>systemctl status kns-relay</code>
watch what it is doing, as it happens (Ctrl+C to stop watching)	<code>journalctl -u kns-relay -f</code>
read its log since the Pi was switched on	<code>journalctl -u kns-relay -b</code>
stop it for now (it starts again at the next boot)	<code>sudo systemctl stop kns-relay</code>

start it again	<code>sudo systemctl start kns-relay</code>
restart it	<code>sudo systemctl restart kns-relay</code>
stop it, and stop it starting at boot	<code>sudo systemctl disable --now kns-relay</code>
start it, and start it at every boot again	<code>sudo systemctl enable --now kns-relay</code>
remove it completely (in the ts890-remote-relay folder)	<code>sudo sh install.sh --remove</code>

Its log says the same as the PC relay's window: when a laptop connects and leaves, how much audio it has passed, and that it sent the radio to receive if a laptop's connection was lost. If a laptop is connected when the relay is stopped, it sends the radio to receive first.

What is different when you are remote

- **Everything on the panel works:** the keys, knobs, meters, bandscope, audio scope, decoders, FreeDV, the recorder, plugins and TCI. Plugins and TCI programs run on the laptop.
- **The USB-only parts are not used:** the COM port, Find radio, the two sound devices for the radio's USB audio, and sharing CAT on a virtual COM port. Give other programs on the laptop the TCI server instead. Your USB choices are kept, ready for when you are back on the cable.
- **Transmit audio** goes to the radio over the network, and the application tells the radio to take it from there (DATA SEND from LAN). Back on USB it goes back to the USB input as before.
- **On a small laptop screen**, make everything smaller with **View settings** → **Display & window** (section 3) — or let the application fit itself to the screen.

Delays

Sound over the internet is never instant, and three small delays add up:

- **Received audio** reaches you about a quarter of a second after it left the radio. Part of that is on purpose: mobile data arrives in bursts, so the application holds about a tenth of a second in hand and plays it out evenly. Without that, the sound broke up.
- **Transmitting** starts as soon as you press MIC or TUNE, but your voice or the carrier follows a moment later, because the radio fills its own network audio buffer first. That buffer is the *VoIP jitter buffer* on the radio's KNS settings; at its largest, 500 ms, it is the safest on a poor connection, and a smaller one makes the start quicker.
- **When you let go** of MIC, the application waits for the last of your audio to reach the radio and play out before it sends the radio to receive, so the end of your last word is not cut off.

Watching the link

While you operate remotely, the right-hand end of the status bar shows how the network link is doing, updated every two seconds: a coloured dot, **Link good**, **fair** or **poor**, and the figures behind it.

Figure	What it means
ping	The time for a round trip to the relay. Only shown through the relay; connected straight to the radio, there is nothing to ask.

jitter	How unevenly the audio arrives. Past about 80 ms it is heard as dropouts.
lost	Audio packets that never arrived, over the last ten seconds.

Good is a ping under 200 ms, jitter under 30 ms and under 1% lost; **poor** is a ping over 500 ms, jitter over 80 ms, or over 5% lost. Rest the pointer on it for the same explanation and the number of dropouts heard since connecting.

Keeping it safe

- Try transmitting into a **dummy load** first: TUNE, then the microphone, then pull the laptop's connection while transmitting and check the radio goes back to receive.
- If the connection drops while you are transmitting, the **relay** sends the radio to receive. The laptop also says so in its log.
- As a last line of defence, set the radio's own **transmit time-out timer** in its menu, so it stops by itself after a few minutes whatever happens. The application's microphone already never transmits for more than three minutes at a time.
- Do not open ports on your home router to reach the radio from the internet. Tailscale makes that unnecessary, and an open port would leave your transmitter's control protected by its KNS password alone.

Check your licence conditions for remote operation. Some countries have rules about it.

If something is not working

What you see	What to do
The radio is busy, or the connection is refused	Something else has the radio's network session. Close the TS-890S Desktop application on the computer at home (and ARCP-890 if you use it), then connect again.
Login refused	Check the KNS user name and password, and whether Administrator account should be ticked. A right password with the wrong account type is refused just like a wrong one.
Cannot connect at all	Is the relay running on the computer at home, and has Windows been allowed to let it use the network? Is Tailscale connected on both computers, on the same account? Is Host the home computer's 100. address?
On a Raspberry Pi, the relay is not running	<code>systemctl status kns-relay</code> and <code>journalctl -u kns-relay -b</code> say why. The commonest cause is a wrong radio address: run <code>sudo sh install.sh</code> again with the right one.
The controls work but there is no sound	From outside your home you are connected to the radio directly rather than to the relay: put the home computer's 100. address in Host . Also check Audio in and Listen are ticked.
"Listening buffer full" in the log now and then	A bad patch on the mobile connection. An occasional one is harmless; if it keeps happening the connection is struggling.
The radio is slow to start transmitting	The radio's VoIP jitter buffer is large (see Delays). A smaller one makes it quicker, if the connection is good.

TS-890S Desktop Front Panel, version 2.4. Written by Leslie McCarthy, EI5GJB. This application is not made by or endorsed by JVCKENWOOD; TS-890S and KENWOOD are their trademarks.

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