# Ferrite user guide

For the Radtel RT-950 Pro, one task at a time.

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CHAPTER 1

# Getting started

Ferrite is replacement firmware for the Radtel RT-950 Pro, and radios built on the same hardware. It is free, and its source is public. This guide shows you how to do things on the radio, one task at a time.

How keys are written:

- [MENU] [0] [5] [3] means press MENU, then 0, then 5, then 3.
- hold [ABC] means hold the ABC key for about a second.
- (knob) +1 means turn the knob one click to the right. (knob) -1 is one click to the left.
- [SIDE1] + (knob) means hold SIDE1 and turn the knob.
- [▲▼] and [◀▶] are the arrow keys.

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## Install Ferrite

WHY Ferrite goes on the radio through the radio's own bootloader. You can always put a new image on, or go back to the original firmware.

Before you start:

- You need the programming cable and a computer with Chrome, Edge or Firefox, or the Ferrite Console desktop app.
- Keep the stock firmware file (the `.BTF`). You need it to go back, and the HF receiver's SSB mode comes from it.
- Installing replaces the radio's channels and settings. Console won't install until it has a full backup of the radio and you have saved it. Keep that file safe, off the computer too.

In short, on Ferrite Console, **Firmware › Install**:

1. Plug in the cable and turn the radio on. Any firmware is fine.
2. **Connect**, then **Back up the radio** (about 4 minutes) and save the backup file.
3. **SSB (optional):** drop in your stock `.BTF`.
4. **Install Ferrite:** about a minute. The radio restarts, Ferrite sets up its storage and opens setup.

Chapter 10 has each step, what to do if the install stops, and how to go back to the stock firmware.

Your calibration is never erased. Nothing comes across from the old firmware, so you add channels again after installing (or import them in Console).

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# First run: setup

`WHY` setup asks the few things the radio needs to know. Every page has a sensible default.

1. Turn the radio on. Setup starts by itself on a new install.
2. Answer each page, then press [OK] for the next one. [BACK] goes to the previous page. [#] skips the rest (on the callsign and owner card pages, [#] changes the letters instead).
3. The pages are:
   - **Callsign.** Type it on the keypad: the digits type letters, and [#] switches between letters and digits. You can leave it empty, but APRS and some transmit features need it.
   - **Region.** Pick where you are. It sets where you may transmit and a few regional defaults.
   - **Owner card.** Your name and contact. Optional. [*] types a space, [#] changes case, and [1] has . - / @ for an e-mail address.
   - **Time.** Time zone, clock format and units. The GPS sets the clock once it has a fix.
   - **Look.** The home layout and the colour theme.
   - **Battery Save.** How much the receivers sleep to save battery.
   - **Summary.** Your choices.
4. After setup, the radio is ready to receive and transmit. It starts with no channels.

To run setup again: [MENU] [0] [9] [7] [1].

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## The home screen and the three slots

WHY everything starts from home. Knowing the slots makes the rest easy.

- The radio has three **slots**: A, B and C. Each one is on a VFO (any frequency) or a channel.
- The **active** slot is the big one. Your keys and the knob work on it.
- The other two are shown as cards. The radio keeps listening to them too. This is called **watch**.
- Press ABC to make the next slot active: A, then B, then C.
- **PTT A** (the big PTT) transmits on the active slot. **PTT B** (the smaller one) always transmits on slot B.
- The bar at the top shows the clock, the screen's name, and marks for the key lock, scan (**SCN**), watch (**DW** for two slots, **TW** for three), unread messages, GPS, Bluetooth, Low Power Mode (**LOW**) and the battery.
- The bar at the bottom shows what the main keys do on this screen.

To go home from anywhere: hold BACK.




The home screen

### Glance at the status

WHY one page with everything the status bar can't fit.

1. Open MENU 0 0 (hold MENU, then 0).
2. Read transmit state, region, inbox, scan, watch, beacon, Battery Save, GPS, Bluetooth, battery and the key lock. OK on a row opens its setting.
3. Press BACK to return.

If a watched slot is receiving, # pauses watch instead. The bottom bar says "# Pause" when that is what it will do.




The Status page

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## The keys

WHY Ferrite has one fixed key layout. Learn it once and it never changes.

- **MENU/OK:** on home, opens quick settings. Held, opens the full menu.
- **BACK:** back one step. Held, goes home from anywhere.
- **Knob and ▲▼:** tune, or step through channels. In lists, the knob changes the highlighted value and ▲▼ move.
- **◄►:** on a channel, change zone. On a VFO, change band.

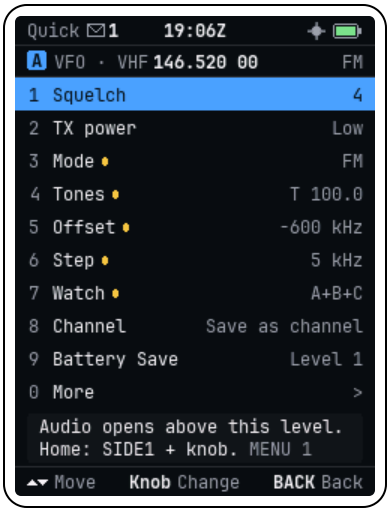
- **ABC:** next slot. Held, edit the slot.
- **V/M:** switch between VFO and channels. Held, open the zone list.
- **SIDE1:** monitor (hear everything, even below squelch). Hold it and turn the knob to set squelch.
- **SIDE2:** start or stop a scan. Hold it and turn the knob for big steps.
- ***:** mute or unmute the active slot. Press it twice within a second to turn the slot off (chapter 2). Held, the quick menu.
- **#:** help: the keys and the menu numbers, a page at a time ([#] again for the next, [BACK] to leave). Held, lock or unlock the keys.
- **Digits:** type a frequency or channel number. Held, a shortcut (see the key card at the end).

## Quick settings

WHY the nine things you change most, for the active slot.

1. On home, press [MENU].
2. Press a digit to jump to that item: [1] squelch, [2] TX power, [3] mode, [4] tones, [5] offset, [6] step, [7] watch, [8] save or edit the channel, [9] Battery Save.
3. Turn the knob to change it. The change applies at once.
4. Press [BACK] to leave. ([OK] opens a bigger editor for that item.)

[0] opens the full menu (More).




Quick settings

## The full menu

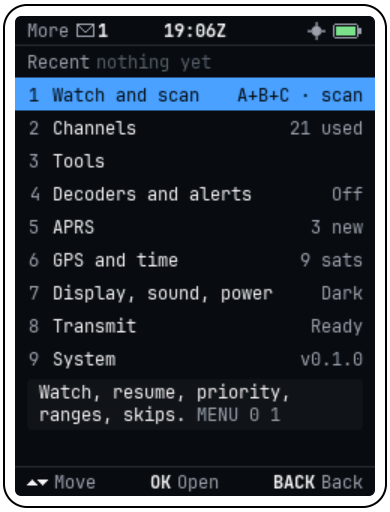
WHY every other setting lives here, in nine groups.

1. On home, hold [MENU]. (Or press [MENU], then [0].)
2. Press the group's digit, then the item's digit.

This guide writes menu paths from home in full: [MENU] [0] [5] [2] is APRS messages. On home, hold [MENU] [5] [2] is the same thing with one press less.

In any settings list:

- [▲▼] move, and the knob changes the value at once.
- [#] puts the value back to its default.
- [*] undoes the last change for a few seconds.
- [BACK] goes back one level.




The full menu

## Edit the slot in place

WHY see and change all of a slot's settings on one screen.

1. On home, hold `ABC`.
2. Move with the arrows. Turn the knob to change a setting. It applies at once.
3. Press `BACK` or `ABC` when you're done.




Editing a slot

## The quick menu

WHY five switches you might want in the dark, without a menu.

1. On home, hold `*`. A small box opens.
2. Then:
   - `knob`: screen brightness.
   - `PTT A`: reverse (listen on a repeater's input).
   - `PTT B`: night red theme.
   - `SIDE1`: GPS Off, Auto or On.
   - `SIDE2`: Bluetooth on or off.
3. The box closes by itself after 5 seconds, or press `BACK`.

The PTT keys never transmit while this box is open.




The quick menu

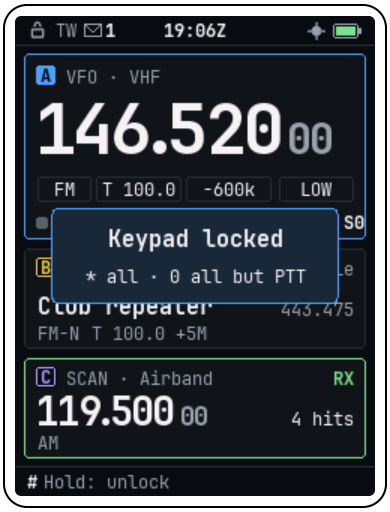
## Lock the keys

`WHY` stops pocket presses.

1. `hold` [#]. The keypad locks at once and a padlock shows in the status bar.
2. For 3 seconds a popup offers more: press [*] to lock all keys, or [0] for all keys but PTT. Do nothing to keep the keypad lock.
3. `hold` [#] again to unlock, whichever lock it is.

- **Keypad** (`hold` [#], let go): the front keys and the knob. PTT, SIDE1 and SIDE2 still work.
- **All but PTT** (`hold` [#], then [0]): every key, the side keys too. PTT still works.
- **All** (`hold` [#], then [*]): PTT too. The padlock turns red.

The volume knob and `hold` [#] always work. The radio always starts unlocked. To lock the keypad by itself after a while: [MENU] [0] [9] [1] [1].




Locking the keys

CHAPTER 2

# Receiving

## Volume

WHY the first thing you reach for.

- Turn the knob on top. It is also the power switch.

## Squelch

WHY squelch keeps the speaker quiet until a signal comes in. Too low and you hear hiss. Too high and you miss weak stations.

1. Hold SIDE1.
2. Turn the knob. The level shows large, and you hear the change as you go.
3. Let go of SIDE1. The level is kept.

Another way: MENU 1, then turn the knob. That screen shows a live signal meter, so you can set the level just above the noise.

A channel can have its own squelch: hold ABC on the channel and change **Squelch**.

Ferrite decides squelch itself, from the signal and noise readings. It opens quickly and shuts the moment a station unkeys, so there's no burst of noise at the end. The APRS slot uses the radio chip's own squelch, which holds through a noisy moment so a packet reaches the decoder whole. To use the chip's squelch on every slot, set MENU 0 9 5 to **Chip**.




Setting squelch

## DTMF heard

When someone sends DTMF, such as a radio's ID at key-up or digits dialled on a repeater, the digits show on that slot's card in green: **DTMF 101#**. They stay a few seconds after the signal ends. Digits only count while the squelch is open, and DTMF decode is off while APRS mode is on. Turn it off with MENU 0 4 3.

## Monitor

WHY hear a weak or quiet signal that doesn't open squelch.

- Hold SIDE1 to listen with squelch open. Let go to stop.
- Or tap SIDE1 once to keep it open. The slot's card says **MON** while it stays open. Tap again to close it.

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# Tune a VFO

WHY the VFO tunes any frequency. Use it to explore, or for a frequency you haven't saved.

1. If the slot shows a channel, press V/M to switch to its VFO.
2. Turn the knob, or press ▲▼, to step by the slot's step.
3. SIDE2 + knob steps 1 MHz at a time.
4. ◀▶ change band.

Each slot has its own VFO.

## Type a frequency

1. On a VFO, type the digits. The screen shows the band and whether you may transmit there.
2. The point goes in by itself after three digits. Six digits enter the frequency: type 1 4 7 3 3 0 tunes 147.330 MHz.
3. For a shorter number, press OK (or *) when you're done: 1 4 6 * 5 2 * tunes 146.520.
4. BACK deletes a digit.

What you type is tuned exactly.




Typing a frequency

## Step size

- hold 6 moves to the next step size (VFO only).
- MENU 6 picks one from the list.

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# Channels

WHY a channel remembers a frequency with its tones, shift, power and name.

1. Press V/M to switch the active slot to channels.
2. Turn the knob, or press ▲▼, to step through the channels in this zone.
3. SIDE2 + knob steps 10 channels.
4. To go to a channel by number, type it, then press OK.




Channel mode

## Zones

WHY zones are folders of channels, such as "Repeaters" or "Air". Each channel is in one zone.

- On a channel, ◂▸ move to the next or previous zone.
- hold V/M opens the zone list. Move to a zone and press OK. The slot goes to that zone and you're back home.
- In the zone list, ABC edits the zone (name, scan, priority), # makes a new one, and * deletes one. Deleting a zone keeps its channels.

With a GPS fix, and channels that have a position, a **Nearby** row at the top lists the channels nearest you.

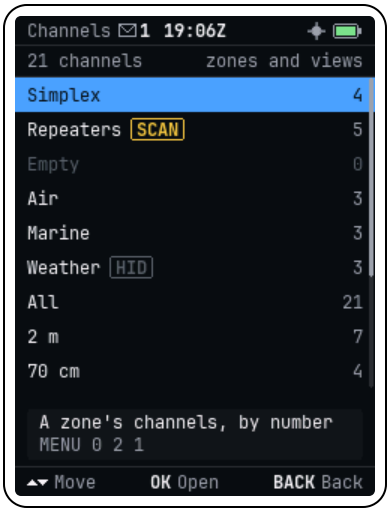



The zone list

## Browse all channels

WHY find, edit, move or delete channels.

1. MENU 0 2 1.
2. Pick a zone, or a view: all channels, by band, recent, or nearby.
3. Press OK on a channel for its actions: edit, rename, move, renumber, copy to the slot, skip, hide, delete.




The channel browser

### Edit a channel

1. Put the active slot on the channel.
2. hold ABC. The channel's zone, name and frequency are at the top, its settings below.
3. Move with the arrows and turn the knob to change. Changes apply at once.
4. BACK when you're done.

### Home channel

WHY one key back to your favourite channel.

1. To choose it: hold ABC on the channel and set **Home** to Yes.
2. To jump there from anywhere on home: hold 0.

### Copy a channel to the VFO

1. On the channel, hold 9. The radio asks "Copy to VFO?".
2. Press OK. The slot is now on its VFO, with the channel's settings. The channel is untouched.
3. Press V/M to go back to the channel.

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## Mute or turn off a slot

WHY silence a busy slot without losing it, or stop listening to it at all.

On home, * works on the active slot:

| PRESS | THE SLOT | ITS CARD SAYS |
|---|---|---|
| * | **Muted:** still receives, but you don't hear it | **Muted** in amber, with **RX** beside it while a signal is in |
| * again, more than a second later | Back to normal | its usual state |
| * * (twice within a second) | **Off:** not received or watched at all | a dimmed card with a dashed outline and **OFF** |
| * on an off slot | Back on | its usual state |




Slot A muted, slot B off

- A muted slot still shows activity: its S-meter, RX tag and green LED work. It never takes the speaker from another slot.
- An off slot's watch turns go to the other slots, so they hear better. It can't transmit, scan or monitor: PTT says "Slot A is off" until you turn it back on.
- The APRS slot can be muted but not turned off.
- Mute and off are not saved: turning the radio off and on brings every slot back to normal.

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## What a slot's card says

Each card has a state word at the top right.

| CARD SAYS | MEANS |
|---|---|
| **idle** | Listening, nothing heard. (The large card shows nothing.) |
| **RX** (green) | Receiving. |
| **MON** (amber) | Monitor is held open with a tap of SIDE1. |
| **Muted** (amber) | Muted with *. With **RX** beside it, it is receiving but you don't hear it. |
| **Off** | Turned off with * *. |
| **off** (grey) | Not watched: watch is off, or set for fewer slots. |
| **scanning** | The slot is scanning. |
| **paused** | Watch is paused, after you transmit or with #. |
| **Heard 88.5** (amber) | A station is there, but your tone keeps it quiet (chapter 3). |
| **DTMF 101#** (green) | DTMF digits heard. |
| **TX** (red) | The radio is sending data on this slot, such as an APRS beacon. |
| **APRS on C** | This slot is on the APRS frequency, so the APRS slot listens for it. |
| **FM**, **FM on B** | Broadcast FM plays on this slot, or on another slot (chapter 6). |

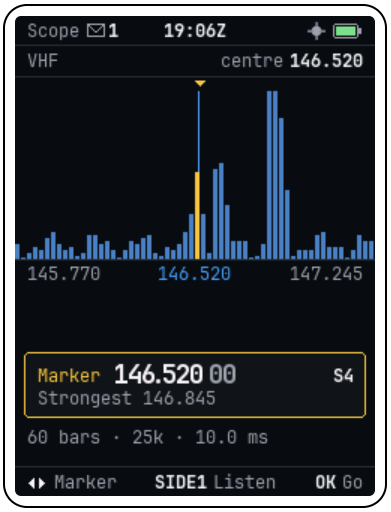
| CARD SAYS | MEANS |
|---|---|
| **Watch off: relay** (amber) | The radio can't watch this slot while broadcast FM plays. |

## Band scope

WHY see activity around your frequency at a glance.

1. hold [1].
2. [◂▸] move the marker. The knob moves the centre.
3. [#] jumps to the strongest signal.
4. [SIDE1] listens to the marker. [SIDE2] listens to the strongest.
5. [OK] tunes the active slot to the marker.
6. hold [MENU] for the scope's settings.

Nothing is heard while the scope sweeps.




The band scope

## Weather radio (US and Canada)

WHY NOAA and Environment Canada weather broadcasts, and their alerts.

- The weather channels come as a zone called **Weather**. Choose it like any zone.
- Alerts: [MENU] [0] [4] [5]. Turn **SAME** on and add your location codes. With no codes, every alert shows.
- An alert fills the screen with a flashing border and a tone. [OK] silences it. [BACK] returns to where you were.

CHAPTER 3

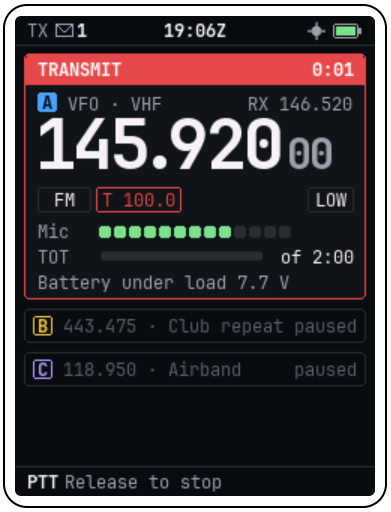
# Transmitting

## Talk

WHY the radio's main job.

1. Hold [PTT A] and talk, with the radio a few centimetres from your mouth.
2. Let go to listen.

- [PTT A] transmits on the active slot. [PTT B] always transmits on slot B.
- The Transmit screen shows the frequency you send on, the power level, your mic level and the time left before the timeout.
- If the radio won't transmit, the screen says why and which setting fixes it. Press [OK] to go there.
- A slot turned off with [*][*] doesn't transmit: press [*] to turn it back on.




Transmitting

**Where you can transmit:** your region's amateur bands. You set the region in setup, or at [MENU][0][9][4].

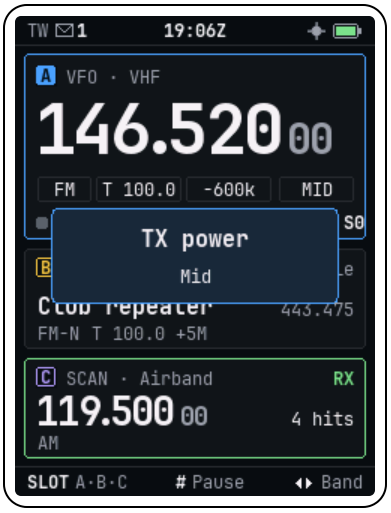
| REGION | 2 M | 1.25 M | 70 CM | 6 M |
|---|---|---|---|---|
| United States | 144–148 | 222–225 | 420–450 | 50–54 |
| Canada | 144–148 | 219–225 | 430–450 | 50–54 |
| United Kingdom, Europe | 144–146 | — | 430–440 | 50–52 |
| Australia | 144–148 | — | 420–450 | 50–54 |
| New Zealand | 144–148 | — | 430–440 | 50–54 |
| Japan | 144–146 | — | 430–440 | 50–54 |
| Other | 144–146 | — | 430–440 | 50–52 |

Every region also has 17 m, 15 m, 12 m and 10 m. Your licence may allow less. Staying inside it is up to you.

## TX power

WHY use the least power that works. It saves battery and keeps the channel clear for others.

- hold [2] cycles low, mid and high. A popup shows the new level.
- Or [MENU] [2], then turn the knob.
- On 1.25 m the radio always transmits on low: the higher levels give no more power out there, only more heat.




TX power

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## Set up a repeater

WHY a repeater relays your signal over a wide area. You need three things from the repeater's listing: its output frequency, its shift (+ or –) and its tone.

The easiest way saves it as a channel:

1. [MENU] [0] [2] [2] (Add repeater).
2. Press [OK] and type the output frequency: type [1] [4] [7] [3] [3] [0]. The shift fills in by itself from the band plan.
3. Press [▼] to **Shift**. If the listing says otherwise, turn the knob.
4. Press [▼] to **Tone**. Turn the knob to the repeater's tone (67.0, 69.3, … 100.0 …).
5. Optional: [▼] to **Name**, press [OK] and type a name.
6. Press [OK] to save. The channel's edit screen opens so you can check it.
7. hold [BACK] to go home. The active slot is on the new channel.



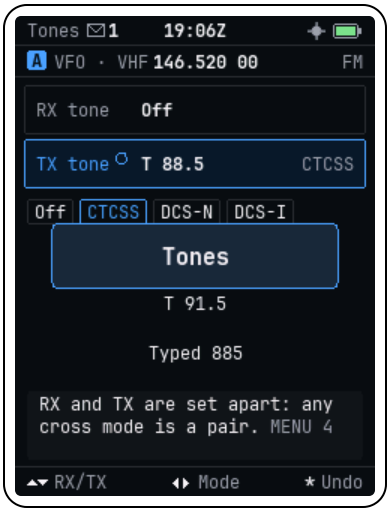

Add a repeater

### On the VFO instead

WHY for a repeater you only need today.

1. On a VFO, type the output frequency: type 1 4 7 3 3 0.
2. hold 7 until the shift you need shows: simplex, +, −.
3. hold 5 opens the tone picker. Type the tone without the point: type 8 8 5 for 88.5. Press OK.
4. To keep it: hold 9, then OK. It is saved as the next free channel.

The shift amount is 600 kHz on 2 m and 5 MHz on 70 cm. To change it: hold 8.




The tone picker

### "They can't hear me"

Check these in order:

- **The tone.** Most repeaters need one. hold 5 shows it.
- **The shift.** + or −, from the listing.
- **Reverse is off.** The shift shows **R** when it's on. hold *, then PTT A turns it off.
- **Power.** Try hold 2 for more.

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## Tones

WHY a tone (CTCSS or DCS) opens a repeater, or keeps other users' traffic quiet on your radio.

1. hold 5 (or MENU 4).
2. **RX tone** is what you need to hear a station. **TX tone** is what you send.
3. ◂▸ choose the kind: Off, CTCSS, DCS-N, DCS-I.
4. Turn the knob, or type the value (8 8 5 is 88.5 Hz).
5. OK keeps it. * undoes.

### Find an unknown tone

WHY you hear a repeater's users but don't know its tone.

1. Tune to the repeater while people are using it.
2. MENU 0 3 5. The radio listens and shows the tone it finds.
3. Press OK to set the RX tone. It then asks about the TX tone: OK sets that too.
4. BACK cancels and keeps your tones.

When a station is heard but your tone keeps it quiet, the slot's card may show "Heard 88.5". Open MENU, then press OK on **Tones** to use it.




Tone search

### Tone burst

Some repeaters open with a 1750 Hz burst. Hold PTT and press SIDE2.

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## Save the VFO as a channel

WHY keep a frequency with all its settings.

1. On the VFO, hold 9 (or MENU 8).
2. The form shows the next free number, the zone and the name. Turn the knob to change the highlighted row. OK on **Name** types one.
3. OK on any other row saves.




Save as channel

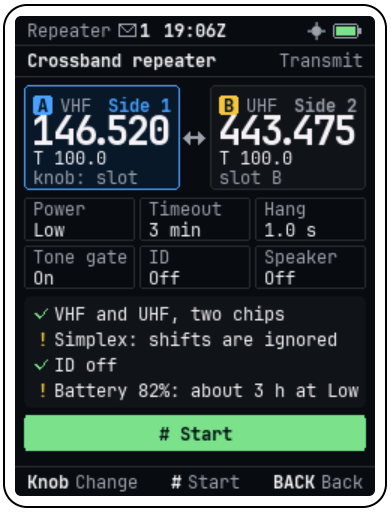
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## Crossband repeater

WHY pass a handheld's signal on to a far repeater, for example from inside a building.

1. Put one slot on a VHF frequency and another on a UHF frequency, with their tones.
2. MENU 0 3 4. Check the two sides and the warnings on the page.
3. Press # to start.
4. Any key stops it. Hold SIDE1 to listen in.

While it runs, watch, scan, APRS and Battery Save pause.




Crossband repeater

## Other transmit settings

| TO | GO TO |
|---|---|
| Transmit timeout | MENU 0 8 1 |
| VOX (hands-free transmit) | MENU 0 8 2 |
| Mic gain | MENU 0 8 3 |
| End tone (roger beep) | MENU 0 8 4 |
| DTMF dialer and memories | MENU 0 8 5 |
| Callsign and CW ID | MENU 0 8 6 |
| Busy lockout (no transmit on a busy channel) | MENU 0 8 7 |

To send DTMF live: hold PTT and press the digits, * or #.

CHAPTER 4

# Scanning and watch

## Scan




Scanning

WHY let the radio look for activity while you listen.

1. Press [SIDE2]. **SCN** shows in the status bar.
   - On a channel, the radio scans the channels in its zone.
   - On a VFO, it scans the band.
2. On a signal, the scan stops so you can listen. It goes on by itself a few seconds after the signal ends.
3. Press [SIDE2] again to stop. The slot goes back to where it started.

While scanning:

- [*] skips the current signal for the rest of this scan.
- [#] skips that channel in every scan from now on.
- [▲▼] change direction and move on from the current signal.
- Digits add or remove zones from the scan.
- [OK] lists the recent hits.
- [PTT] transmits on the frequency the scan stopped on.

### Scan settings

| TO | GO TO |
|---|---|
| How long to wait after a signal ends | [MENU] [0] [1] [2] |
| How often to check the priority channel | [MENU] [0] [1] [3] |
| Frequency ranges with their own step and skips | [MENU] [0] [1] [4] |
| See and clear skipped frequencies | [MENU] [0] [1] [5] |
| Direction, where to stop, scanning repeater inputs | [MENU] [0] [1] [6] |

A zone's priority channels are set in the zone list: hold [V/M], then [ABC] on the zone.

## Watch: listen to two or three slots

WHY keep an ear on a second or third frequency, such as a repeater and a simplex channel, or APRS.

- hold [4] turns watch on or off. A popup shows the new state.
- [MENU] [7] chooses which slots: off, A+B, or A+B+C.

How it works:

- The active slot is heard first. A watched slot is heard when the active one is quiet.
- A watched slot that receives lights up on its card.
- The radio never changes the active slot by itself. Only you do.
- To answer on slot B, press [PTT B]. To answer on slot C, press [ABC] until C is active, then [PTT A].
- While a watched slot is receiving, [#] pauses watch for a minute. The bottom bar shows "# Pause".
- After you transmit, watch waits 30 seconds so you don't miss the reply. The APRS slot keeps listening meanwhile.
- A slot turned off with [*] [*] isn't watched. Its turns go to the other slots.

Watch and scan can run at the same time: one slot can scan while you listen on another.




Watch on or off

---

## Frequency counter

WHY find the frequency another radio is transmitting on, from close by.

1. Hold [SIDE2] on its own. The counter opens.
2. Key the other radio close to this one.
3. The counter shows the frequency and keeps a list of recent hits.
4. [OK] copies the frequency to the VFO.

The counter never transmits.

CHAPTER 5

# APRS

APRS is a packet system on one shared frequency (144.390 MHz in North America). Stations send their position, short messages and weather. Ferrite decodes it in the background while you use the radio for voice.

## Before you start

1. Set your callsign: MENU 0 8 6 1. Nothing is sent without one.
2. Your SSID and map symbol: MENU 0 5 5. SSID 7 (handheld) is the usual choice. A comment (MENU 0 5 5 3, up to 40 characters) goes out with every beacon. Ambiguity (MENU 0 5 5 6) sends a less exact position. Mic-E (MENU 0 5 5 7) sends shorter beacons with a status: Off duty, En route, In service, Returning, Committed, Special or Priority. Off sends the usual beacon. With no GPS, set a fixed position: MENU 0 5 5 5, and MENU 0 5 5 4 to **Fixed** to always use it.
3. The APRS frequency: MENU 0 5 4. It is set for your region already.

## Turn APRS on or off

WHY APRS mode gives slot C to APRS. You keep A and B for voice.

1. MENU 0 5 3, then knob +1 (or OK).
2. Slot C tunes to the APRS frequency and decodes in the background. It starts muted: packets are decoded, not heard. * on slot C lets you hear them.
3. Do the same again to turn it off. Slot C goes back to what it was.




The APRS slot

### The APRS card

While APRS mode is on, slot C's card shows APRS. The large card (slot C active) shows, from the top:

- **APRS Mode**, then the card's state on the right (**Muted**, **RX**). When A or B shares C's VHF chip, a note says who comes first: **APRS first** or **A·B first** (see below).
- The frequency, with **3 heard · 11 /hr**: the stations heard since you turned the radio on, and in the last hour, so you can tell when the channel is busy.

- The two newest stations: callsign, how long ago, and their distance and direction from you ("2.4 km NE"). "via digi" means you heard it through a digipeater. With no GPS fix, only the ages show.
- Unread messages take the second row: "2 new from VE3KPW-9".
- Your last beacon: "Last beacon digi'd by VE7RHS" when a digipeater repeated it, or "not heard back" in amber.
- The beacon row: "Beacon in 5m", "Beacon off" or "no fix", with the beacon power at the right.

The small card shows the frequency, the counts and the last station heard.

With slot C active:

- [OK] opens the APRS list. [OK] [1] reads your messages.
- hold [V/M] sends a beacon now. A tap of [V/M] only reminds you.
- [PTT A] opens a new message. It never sends voice on the APRS frequency.
- [*] mutes or unmutes C.

### APRS first or A·B first

The radio has one chip for 2 m. When slot A or B is also on that band, the chip takes turns between them and C.

- **APRS first** (the default): C gets long turns and A and B short looks. C misses fewer packets; a call on A or B can be heard a moment late.
- **A·B first:** A and B get their usual turns, and C misses more packets.

Choose at [MENU] [0] [5] [9] [7]. The note on the card shows only while a slot shares C's chip. With A and B on 70 cm, or turned off, C has the chip to itself and the note goes.

---

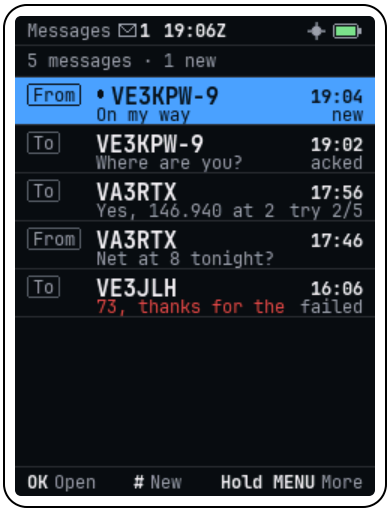
## Read messages

WHY see what other stations sent you.

An envelope in the status bar means something is unread.

1. [MENU] [0] [5] [2]. Messages are listed newest first: **From** for received, **To** for sent, with their state (acked, retry, failed, cancelled).
2. Move to a message and press [OK] to read it.
3. [BACK] returns to the list.

With APRS mode on and slot C active, you can also press [OK] on home, then [1].




Messages

---

# Reply or send a message




Replying

1. Open the message (above) and press OK to reply.
2. The quick messages show ("73", "On my way", "Call me" ...). Turn the knob to pick one and press OK to put it in. They're only a shortcut: press * (Write) for an empty message, or just start typing. Turn the knob on an empty message to see them again.
3. Type your own. Text is predictive: press each letter's key once, turn the knob to pick the word, and * for a space. # goes round T9 (word by word), abc, ABC and 1 2 3 (letter by letter); the screen says which.
4. Punctuation is on 1: press it once for a full stop, again for the next mark: . , ? ! ' / - @ :. The marks show above the hint bar while you pick. hold a digit to type the digit (73, 146.52).
5. Press OK to send. The message shows "pending" until the other station acknowledges it, and "try 2/5" and so on while the radio sends it again.

The radio tries a message 5 times over about 7 minutes, then marks it failed. Up to 4 messages can be sending at once.

**Stop, resend or delete:**

- To stop one that's still sending, select it and hold MENU, then press OK on **Stop sending**. It stays in the list as "cancelled".
- To try a failed or cancelled one again, hold MENU on it and choose **Send again**. It goes as a new message, so you don't retype it.
- To delete one message, hold MENU on it (in the list, or with it open), choose **Delete message** and press OK twice. It works on any message, yours or to you. One still sending stops.
- **Delete all messages** (hold MENU in the list) clears the whole list and stops anything still sending.
- Messages still sending when you turn the radio off show as failed when you turn it on again. Nothing old goes out by itself.

To start a new message: MENU 0 5 2, then #. Pick a recent station, a contact or a station heard with the knob, or type a callsign.

With APRS mode on and slot C active, PTT A opens a new message.

---

# Auto reply while you're away

The radio can answer messages for you, once per station, after a short delay. MENU 0 5 9 9 opens it:

1. **Auto reply:** turn it on.
2. **Reply to:** who gets an answer. * is everyone; VE7* is every callsign starting VE7; or type one callsign, such as VE3DTJ-7. The * key types the *.
3. **Delay:** 10 seconds, 30 seconds, 1 minute or 2 minutes.

4. **Message:** what to send, up to 45 characters, such as "Away from the radio, back at 5".

UP and DOWN move between the rows, the knob changes them, and OK types the pattern or the message.

A station gets one reply in 30 minutes, however many messages it sends, so two radios on auto reply don't answer each other forever. Services, acks and your own callsign never get one. Each reply shows in your sent messages like any other.

---

## Stations heard

WHY see who is around and how far away.

1. MENU 0 5 1. Newest first, with distance and route.
2. OK opens a station: position, course, comment, distance and a direction arrow.
3. On a station, OK writes it a message and # saves it as a waypoint.

The list keeps the last 50 stations and survives a restart. After you turn the radio on, stations from before show "earlier" until GPS knows the time. To empty it, choose 7 in the APRS list: **Clear the heard list**.




Stations heard

---

## Send a beacon

WHY put your position on the map.

**Now, once:**

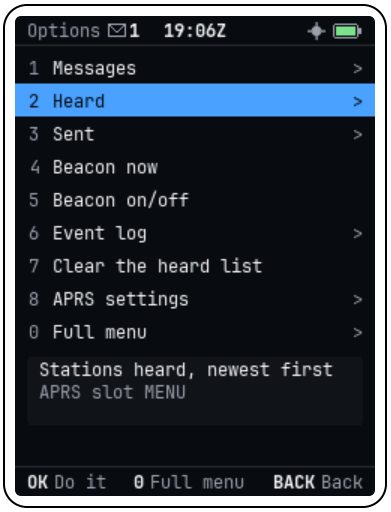
1. Make slot C active (APRS mode on), then press OK. The APRS list opens.
2. Press 4 for **Beacon now**, then OK.

Quicker: with slot C active, hold V/M. In the message editor, tap V/M.

The APRS list is the same from slot C (OK) and from the stations heard (hold MENU): 1 Messages, 2 Heard, 3 Sent (your beacons since power-on and who repeated them), 4 Beacon now, 5 Event log, 6 Clear the heard list, 7 APRS settings. Automatic beacons are set in MENU 0 5 6 1.

**Automatically:**

1. MENU 0 5 6.
2. **Mode:** manual, every 1 to 60 minutes, or **Smart**. Smart follows your speed: every 30 minutes when you're still, about every 6 minutes walking, every 3 minutes from a bike up, and straight away when you




APRS options

turn a corner. With APRS mode off, timed or smart beacons still take slot C to send them. Its card says **APRS Beacon**, and nothing is decoded.

3. **After voice TX:** send a beacon after you talk.
4. **Power:** the power for beacons and messages. On slot C, `hold` [2] changes it too.
5. **Telemetry** ([MENU] [0] [5] [6] [4]): off unless you turn it on. Then every beacon ends its comment with the battery voltage, the radio's temperature and the beacon power in watts, such as `Ferrite 7.8V 31C 9W`. Maps such as aprs.fi show them with your comment. Nothing extra is sent. A long comment leaves less room: the values that don't fit are left off, power first.

---

## Your beacons: Sent

`WHY` see whether your beacons reach a digipeater.

1. With slot C active, [OK], then [3] (**Sent**).
2. Your beacons since you turned the radio on, newest first: how long ago each went out, and up to two digipeaters heard repeating it ("by VE3RSB-1"). "not heard back" in amber means none was heard.

The list keeps the last 20 and empties when you turn the radio off.

---

## Digipeat

`WHY` relay other stations' packets, to fill a gap in coverage.

- [MENU] [0] [5] [7]. Turn it on and pick the aliases. Leave it off unless your area needs it.

---

## Use the radio as a TNC (KISS)

`WHY` let an app on your computer or phone send and receive APRS through the radio.

1. [MENU] [0] [5] [8]: **Cable** or **Bluetooth**.
2. For Bluetooth, turn it on too: [MENU] [0] [9] [2] [1].
3. Connect from the app. Received packets go to the app, and the app's packets are sent on the APRS frequency.

Turning KISS on lets apps transmit. Every normal transmit check still applies.

iPhone APRS apps look for a kind of Bluetooth service that the radio's module can't offer, so they won't find the radio. Android apps that use plain Bluetooth serial work.

## The event log

WHY every decode and alert in one place.

1. MENU 0 4 1.
2. ◂▸ filter by source. OK opens an event.
3. hold MENU to mark all read or clear the log.

## Message sound

MENU 0 7 5 5 picks the sound for a message to you: Off, Ding, Mail, Packet, Droid or Pager. MENU 0 7 5 6 sets how loud it is.

## Advanced APRS settings

MENU 0 5 9. The defaults suit nearly everyone.

| TO | GO TO |
|---|---|
| Path: none, WIDE1-1, WIDE1-1,WIDE2-1, APRSAT, ARISS, or your own | MENU 0 5 9 1 (your own: MENU 0 5 9 2) |
| TX delay | MENU 0 5 9 3 |
| TX level | MENU 0 5 9 4 |
| FX.25 (error correction on what you send) | MENU 0 5 9 5 |
| Mute the APRS slot when APRS mode comes on | MENU 0 5 9 6 |
| APRS first or A·B first | MENU 0 5 9 7 |

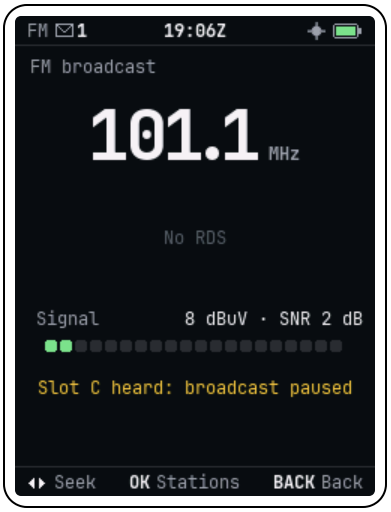
CHAPTER 6

# FM broadcast and HF

The radio has a second receiver chip for broadcast FM, AM and shortwave. Ferrite uses it for FM broadcast on any slot, and for HF mode.

## FM broadcast

WHY music and news, while the radio keeps listening to your other slots.




FM broadcast

**On a slot:**

1. On a VFO, type a broadcast frequency: type [1][0][1][1], then [OK], for 101.1 MHz.
2. The slot plays broadcast FM. Its card shows the station, stereo and the station's text (RDS) when it sends one. Many stations also send their format: the card's top line shows it (Jazz, News) in place of Broadcast.
3. Turn the knob or press [▲▼] to tune. [◀▶] seek the next station.
4. [MENU] on it: the step, AGC, radio monitor, the sleep timer, and [5] your saved stations. Turn the knob to one and press [OK] to play it.
5. Tune the slot out of the broadcast band and it is a normal slot again.

The same settings are in [MENU][0][2][6].

While broadcast plays:

- Your other slots keep watching. When one of them receives, the broadcast goes quiet, and comes back 2 seconds after.
- [PTT] stops the broadcast, transmits, and starts it again after.
- To keep a station, save the slot as a channel: hold [9], then [OK]. Saved stations are channels in any zone; [MENU][5] on the broadcast slot lists every channel on 76-108 MHz.
- The sleep timer mutes the broadcast slot when its time is up; [*] on it plays it again.

# HF mode (shortwave and AM)

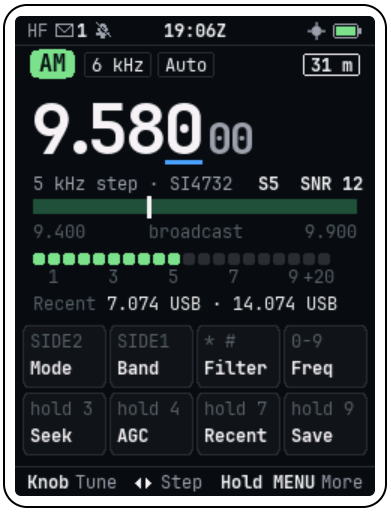
WHY listen to shortwave broadcasts and the HF amateur bands.

1. MENU 0 3 3.
2. Tune:

| TO | PRESS |
|---|---|
| Tune | Knob or ▲▼ |
| Big step (1 MHz) | SIDE2 + knob |
| Change band | ◀▶ |
| Change mode: AM, or FM from 18 MHz | * |
| Type a frequency | Digits, * for the point |
| The last 10 frequencies | # |
| Step, bandwidth, AGC | hold MENU |
| Save as a channel | hold 9 |
| Leave | BACK |

While HF mode is open, watch, scan, APRS and beacons pause.

- **Transmit:** from 18 to 64 MHz, where your region allows, in FM. AM is receive only.
- **SSB and CW** aren't built yet; they'll come below 18 MHz only. HF mode receives AM everywhere, and FM from 18 MHz.
- **Bandwidth:** 6 kHz suits strong stations; narrower cuts noise and neighbours on weak ones.
- Some early boards can't hear medium or long wave. That is a hardware fault.




HF mode

CHAPTER 7

# GPS and Bluetooth

## GPS: Off, Auto or On

WHY GPS gives APRS your position, sets the clock and finds nearby channels. It also uses battery, so the radio only runs it when it's needed.

- MENU 0 6 1: Off, Auto or On.
- Or hold *, then SIDE1. Each press steps Off, Auto, On. The quick menu shows the new state.

**Auto** is the default. The GPS turns itself on only while something needs your position:

- APRS beacons, when you haven't set a fixed position.
- A GPS screen: position, satellites, waypoints, or going to a waypoint.
- The arrival alarm, while it watches a waypoint.
- The clock from GPS: one fix after you turn the radio on.

When nothing needs it any more, the GPS turns off a minute later. The first fix after it was off can take longer.

**On** keeps the GPS ready all the time, for the quickest fix. **Off** never turns it on.

Low Power Mode turns the GPS off, whatever this setting says.

A satellite icon in the status bar shows while the GPS is on. It is an outline while searching and solid with a fix. The GPS sleeps between fixes to save power. It wakes once a minute, before each timed beacon, and when you open a GPS screen.

## Where am I?

1. MENU 0 6 2.
2. The fix, satellites and accuracy are at the top. Below: latitude and longitude, grid square, altitude, speed, course, local time and UTC, and the nearest waypoint.
3. ◂▸ show the satellites: a sky plot and a signal bar for each.
4. # marks this spot as a waypoint.

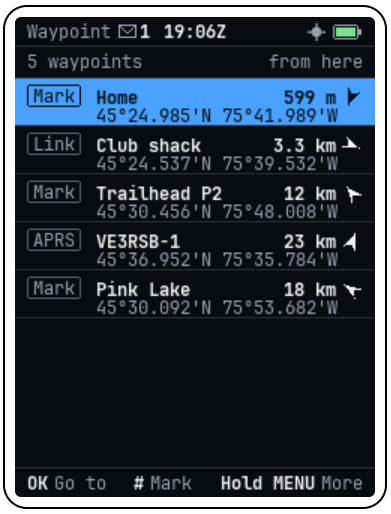



GPS position

# Waypoints

WHY mark a place and find your way back to it.

1. MENU 0 6 7. Waypoints are listed nearest first, with distance and direction.
2. OK on one opens a dial with the distance, bearing and time to get there. It turns as you move.
3. # marks where you are now.




Waypoints

---

# Time, units and position format

| TO | GO TO |
|---|---|
| Coordinates | MENU 0 6 3 |
| Metric or imperial | MENU 0 6 4 |
| Time zone | MENU 0 6 5 |
| Clock format, or set it by hand with no GPS | MENU 0 6 6 |
| GPS during receive and transmit | MENU 0 6 8 |
| A fixed position, for when there is no fix | MENU 0 6 9 |

The clock shows Z after the time when it is UTC, and --:-- when it has no time yet.

---

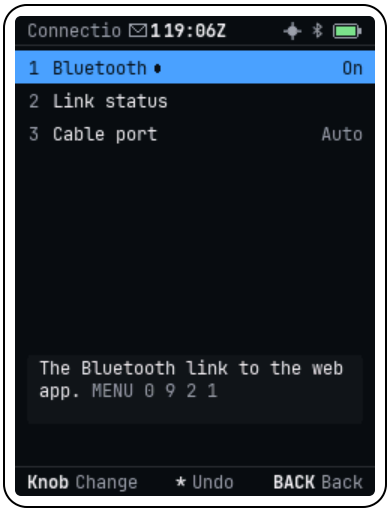
# Bluetooth

WHY connect the radio to Ferrite Console or an APRS app without a cable.

1. Turn it on: hold [*], then [SIDE2]. Or [MENU] [0] [9] [2] [1]. It is off by default.
2. Pair from your phone or computer. The radio shows up as "walkie-talkie".
3. [MENU] [0] [9] [2] [2] shows the link.

The Bluetooth icon in the status bar shows while a device is connected.

If you set a PIN ([MENU] [0] [9] [3] [1]), every Bluetooth connection asks for it first. The cable never asks.




Bluetooth on

---

# Ferrite Console

Ferrite Console is the companion app, in the browser at console.ferritefw.dev or as a desktop app. Over Bluetooth it needs Chrome or Edge; on an iPhone or iPad, the Bluefy browser (Safari has no Bluetooth for web pages).

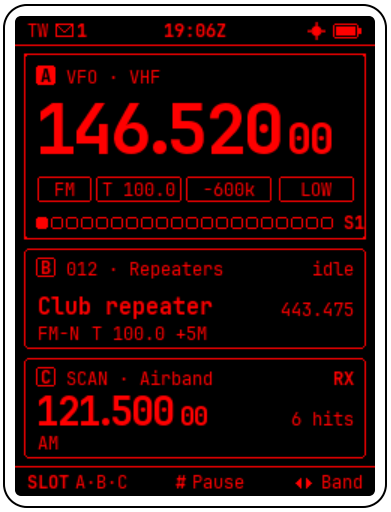
Over Bluetooth it does Live View, channels and zones, settings and APRS. Firmware updates and Listen need the cable. Chapter 10 covers it all.

While Console writes to the radio, the radio shows the progress. [BACK] cancels.

CHAPTER 8

# Display, sound and power

## Brightness and night red




Night red

WHY a dim, red screen keeps your night vision. A bright one reads in the sun.

- **Brightness:** hold * , then turn the knob.
- **Night red:** hold * , then PTT B . Do the same again to go back.

## Theme

1. MENU 0 7 1 .
2. Turn the knob: **Dark**, **Daylight** (high contrast for sun), **Night red** or **Cyberpunk**.

## Home layout

1. MENU 0 7 2 .
2. Turn the knob:
   - **Watch:** one slot large, two cards. The default.
   - **Single + scope:** one slot with all its settings and a small band scope.
   - **Watch + activity:** three equal slots with their last minute of activity.

The keys work the same in every layout.

## Screen and lights

| TO | GO TO |
|---|---|
| S-meter style, power-on message, boot screen | MENU 0 7 3 |

| TO | GO TO |
|---|---|
| Backlight timeout, brightness, light while transmitting, what wakes the screen, keypad light | MENU 0 7 4 |
| The LEDs | MENU 0 7 6 |
| How long menus stay open | MENU 0 7 9 |

## Sound

- **Volume:** the knob on top.
- **Key beep, beep volume, alert tones, waypoint arrival tone, message sound and its volume:** MENU 0 7 5.
- **End tone (roger beep):** MENU 0 8 4.

**Speaker-mics:** plug into the side connector. Never use an adapter that grounds a speaker wire (the Kenwood style). It can burn out the radio's audio amplifier.

## Battery

The battery icon is green above 80 %, amber down to 31 %, and red at 30 % and below. It blinks red when the battery is too low to transmit. The Status page (MENU 0 0) shows the percentage.

### Battery Save

WHY the receivers sleep between short checks. Deeper levels last longer but hear the start of a call later.

1. MENU 9.
2. Turn the knob:

| LEVEL | RECEIVER ON | OFF | A CALL CAN BE HEARD UP TO |
|---|---|---|---|
| Off | always | — | at once |
| 1 | 300 ms | 500 ms | 0.5 s late |
| 2 | 180 ms | 700 ms | 0.7 s late |
| 3 | 180 ms | 800 ms | 0.8 s late |

Watched slots follow the same cycle.

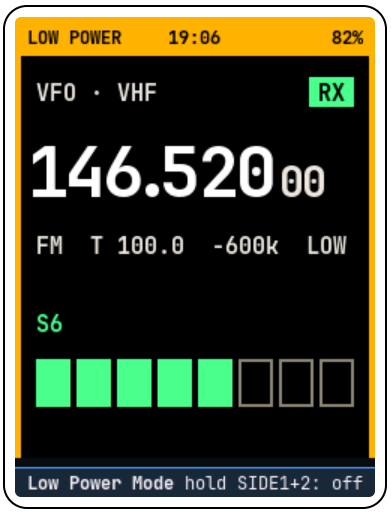
## Low Power Mode

`WHY` stretch a low battery. The radio keeps only what you need to talk on one frequency.

- Scan, watch, APRS, the decoders, broadcast, HF, GPS and Bluetooth turn off.
- The screen dims and shows one slot in an amber frame. **LOW** shows in the status bar.
- Tuning, the menus and editing work as usual.

To set it: `MENU` `0` `7` `7` `2`: **Off**, **On** or **Auto**.

- **On** turns it on at once, and it stays on until you leave it.
- **Auto** (the default) turns it on below the level at `MENU` `0` `7` `7` `3` (20 % unless you change it), and off again on the charger at 80 %.
- **To leave it now:** hold `SIDE1` and `SIDE2` together for a second.




Low Power Mode

## Auto power off

`MENU` `0` `7` `8`: off, or after 30 minutes to 4 hours without use.

## Dynamic clocking

`WHY` the radio spends most of its time waiting for a signal, and it doesn't need full speed to wait.

Ferrite runs the processor at 24 MHz at rest. It goes to full speed (120 MHz) only while something needs it:

- a key or the knob
- APRS and the decoders
- a scan, the band scope and the other special modes
- transmit
- a Bluetooth or cable connection

A second after the last need ends, it slows down again. You won't notice the switch.

It's on by default, with nothing to set. On our bench, a resting radio (screen off, receivers sleeping in their cycle) drew about 19 mA instead of about 65 mA at full speed all the time.

APRS mode is the exception: it keeps its receiver awake and the processor at full speed, ready to decode, so it uses noticeably more.

If you ever suspect it, MENU 0 9 9 5 (MCU clock) has **Fixed**, which keeps full speed always and uses more battery.

Low Power Mode is separate: it turns features off. Dynamic clocking saves power with everything still on.

## Turning off

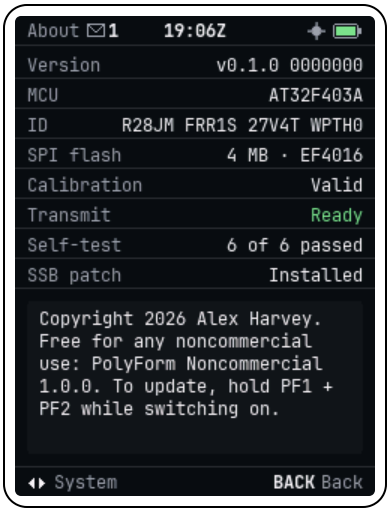
Turn the volume knob off. The screen says "Saving..." while it finishes writing, then the radio turns off.

CHAPTER 9

# Updating, backups and reset

## Which version do I have?

1. MENU 0 9 8.
2. About shows the version, the self-test result, the calibration, the FM and HF chip's revision (SI4732) and the SSB support.




About

## Update Ferrite

WHY new releases fix things and add features. Your channels, settings and SSB support stay.

With Ferrite Console (chapter 10 has the details):

1. Connect the radio by cable.
2. Open **Firmware › Update** and press **Update...**.
3. Check the versions, then press **Update**. About a minute; keep the cable in.
4. The radio restarts on the new version.

**If the radio doesn't restart by itself:** turn it off, hold the bottom two side buttons ( SIDE1 and SIDE2 ), and turn it on. The screen stays dark while the bootloader waits; press **Try again** in Console.

The bootloader is the radio's own and is never changed, so an update can always be tried again.

## Backups

WHY the backup made at install is your way back to the original firmware, with its channels and settings.

- Keep the backup file from the install (Console names it with your radio's ID), and the stock firmware's `.BTF`.
- Your calibration is never erased, so it needs no restore.
- While on Ferrite, save your channels and settings in Console as a `.ferrite` codeplug file (chapter 10).

---

## Go back to the original firmware

On Ferrite Console's **Firmware › Back to stock** tab: drop in your backup file and the stock `.BTF`, connect the radio by cable (still on Ferrite), and press **Back to stock**. Console writes your old channels and settings back (never the calibration), then installs the stock firmware. Chapter 10 has the steps.

---

## Run setup again

`MENU` `0` `9` `7` `1`. Your channels stay.

---

## Reset

`WHY` start again from a clean radio.

- `MENU` `0` `9` `7` `2`. The screen lists what goes and what stays, and asks before it resets.
- It erases every setting, the PIN, channels, zones, messages and the event log. Calibration and the SSB support stay.
- To reset the settings only, hold `MENU` while turning the radio on.

---

## PIN lock

`WHY` stop others using the radio or changing it over Bluetooth.

| TO | GO TO |
|---|---|
| Turn the PIN on or off | `MENU` `0` `9` `3` `1` |
| Channel-only mode: no VFO, no editing | `MENU` `0` `9` `3` `2` |
| Change the PIN | `MENU` `0` `9` `3` `3` |

Three wrong PINs make the radio wait 30 seconds before the next try.

## Key test

MENU 0 9 1 2 shows each key as you press it. Useful if a key seems not to work.

CHAPTER 10

# Ferrite Console

Ferrite Console is the companion app for the radio. It installs and updates Ferrite, edits channels, zones and settings, shows the radio's screen with its keys, and handles APRS messages. Everything it writes goes through a backup and a list of changes first.

---

## What it is and where to get it

WHY pick the way in that suits your computer.

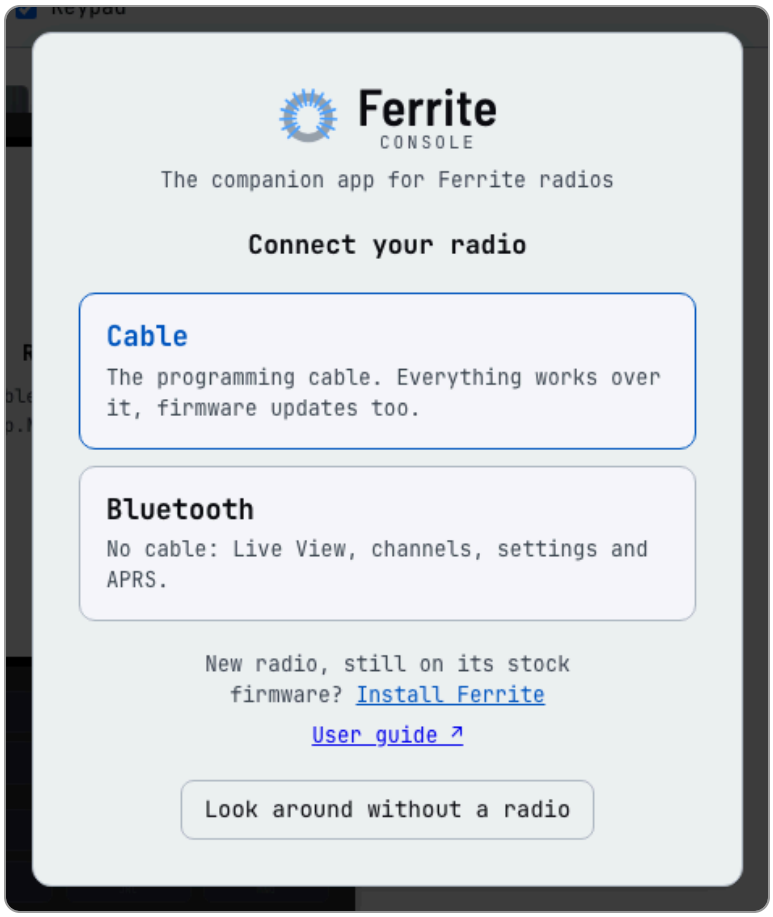
- **In the browser:** open console.ferritefw.dev. Nothing to install.
  - Cable: Chrome, Edge or Firefox, on a computer.
  - Bluetooth: Chrome or Edge.
  - iPhone and iPad: the Bluefy browser, Bluetooth only. Safari can't reach the cable or Bluetooth.
- **As a desktop app:** the same Console in its own window, with its own list of ports and radios.

The sidebar has the jobs: **Live View**, **Channels & Zones**, **Radio Settings**, **APRS** and **Firmware**. Under **More**: **Event Log**, **Terminal** and **About**. **User guide ↗** at the bottom opens this guide.

---

## Connect the radio

WHY Console asks first how to reach the radio.




The welcome

1. Turn the radio on.
2. Open Console. The welcome asks how to connect.
3. Pick a way:
   - **Cable:** plug in the programming cable and pick its port. Everything works over the cable, firmware updates too.
   - **Bluetooth:** turn the radio's Bluetooth on (hold `*`, then `SIDE2`), then pick the radio. Live View, channels, settings and APRS work; updates, installs and Listen need the cable.
4. The welcome closes once the radio answers. The bar at the top says **Connected**, with the callsign and the version.

- If the radio has a PIN (`MENU` `0` `9` `3` `1`), Console asks for it on Bluetooth. Type it and press **Unlock**. The cable never asks.
- Every radio calls itself "walkie-talkie" on Bluetooth. The desktop app lists each one by its Bluetooth ID instead, with the one you used last at the top.
- If the link drops (cable pulled, the radio restarted, Bluetooth out of range), the bar says **Radio lost: reconnecting...** and Console picks the same radio up again by itself, with no welcome. **Stop** ends the retrying. Listen stays off until you turn it on again.
- **Look around without a radio** closes the welcome. Files, the library and the editors work without a radio. **Disconnect** is at the top right.

**If it won't connect:**

- "No answer" on the cable: the radio is most likely still on its stock firmware. The welcome offers **Install Ferrite** (next section).
- A way that is greyed out says why: usually the browser. Try Chrome or Edge.
- Plug the cable straight into the computer. Long USB extensions and some hubs lose data.

---

# Install Ferrite on a new radio

WHY the first install takes a radio from its stock firmware to Ferrite, with a full backup first.

You need the programming cable, a computer with Chrome, Edge or Firefox (or the desktop app), and about 10 minutes. Ferrite runs on the Radtel RT-950 Pro, and radios built on the same hardware.

1. Open **Firmware › Install** and press **Start install...** (or **Install Ferrite** on the welcome).
2. **Connect:** plug in the cable, turn the radio on, and press **Connect cable...**. Any firmware is fine.
3. **Back up:** press **Back up the radio**. Console reads the radio's whole memory and checks it, about 4 minutes. Keep the cable in.
4. **Save the backup:** press **Save the backup...**, then **I have saved it**. The file is named with your radio's ID. **Check the saved file...** checks the copy you kept. Nothing is written to the radio until you confirm.
5. **SSB (optional):** drop in your stock `.BTF` (from the radio maker's website). Console takes the SSB support from it, here on your computer. **Skip** installs without it; USB, LSB and CW then stay hidden.
6. **Install:** press **Install Ferrite**. About a minute. Don't transmit.
7. **Done:** the radio restarts into Ferrite and opens its setup (chapter 1).

- Keep the backup file safe, off the computer too. It is the only way back to a fully working stock radio. Never post it: it holds your radio's calibration.
- If the install stops part way, the radio waits in its bootloader with a blank screen. That's safe: press **Try again**. If it doesn't answer, turn it off, hold `SIDE1` and `SIDE2` and turn it on, then try again.
- A radio already on Ferrite: the wizard says so and sends you to **Update**.

---

# Back to stock

WHY take Ferrite off and put the radio back as it was.

On **Firmware › Back to stock**:

1. Drop in your backup (`.bin`) and the stock firmware (`.BTF`).
2. Connect the radio by cable, still on Ferrite.
3. Press **Back to stock**. Console checks the backup is this radio's own. If it can't tell, it asks you to type the radio's ID (About, `MENU` `0` `9` `8`, shows it).
4. Console writes your old channels and settings back, never the calibration, then installs the stock firmware.
5. The radio restarts on the stock firmware, as it was before Ferrite.

If it stops part way, don't let Ferrite start again: turn the radio off, hold `SIDE1` and `SIDE2`, turn it on, and press **Send the stock firmware only**.

---

# Update Ferrite

`WHY` new releases fix things and add features. Your channels, settings and SSB support stay.

1. Connect the radio by cable. Updates don't go over Bluetooth.
2. Open **Firmware › Update**. It shows your radio's version and the latest one. "Up to date" means there is nothing to do.
3. Press **Update…**. The wizard has three steps:
   - **Check:** the version now, the new one, and the signature. "Signed by Ferrite" means the file is a Ferrite release.
   - **Update:** about a minute. Keep the cable in and don't transmit.
   - **Done:** the radio restarts on the new version.

- **A file of your own:** under **Advanced: install a .btf file**, press **Choose .btf…** and pick the `.btf` with its `.minisig` (the signature). Console checks the file, then **Update** installs it. "Not signed" means it isn't a Ferrite release. Console won't install a file with a bad signature.
- **If the update stops:** the radio waits in its bootloader with a blank screen. Press **Try again**. After closing Console, the Update page offers **Open the cable and resume**.

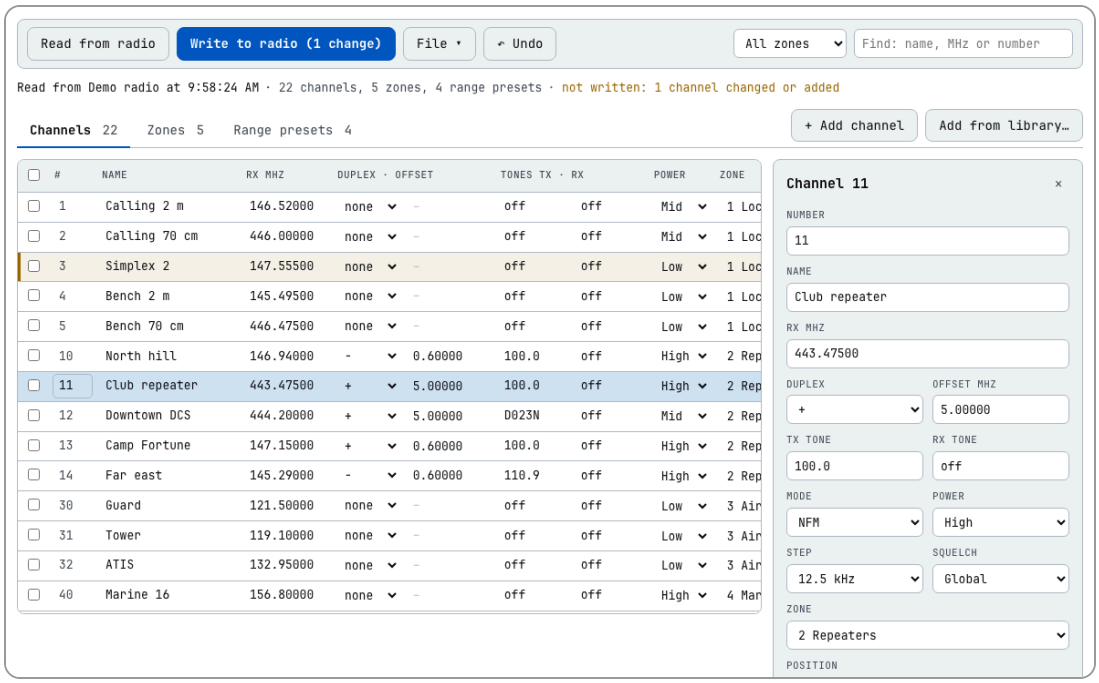
> ## Finish the update (a new data layout)
>
> Some releases keep the radio's data in a new layout (more channels and zones). The new firmware leaves your old data untouched and shows **Finish the update** on the radio until Console moves it. Console does that by itself as part of **Update**: no extra step.
>
> 1. Console backs up the old data first: it keeps a copy, and saves it as a file too (`ferrite-<callsign>-layout2-backup-<date>.bin`) unless you untick **Save … to a file too**.
> 2. It moves everything (channels, zones, settings, contacts, waypoints, stations heard, messages, the event log) and restarts the radio. About a minute; the bar shows the seconds left.

> 3. **Done** lists what moved. A zone of more than 256 channels is split: its first 256 stay, the rest go to a new zone with the same settings ("Repeaters 2").
>
> - **If it stops** (the cable pulled, the radio turned off): nothing is lost. The banner **Finish the update...** at the top of Console starts it again from Console's copy.
> - **A radio that already shows Finish the update** (flashed another way, or the move was stopped): connect by cable and press **Finish the update...** in the banner. On another computer, open **Advanced** and **Use a saved backup...** with the `.bin` file.
> - Until it's done, Console doesn't read or write the radio's channels or settings, and the radio saves nothing. On the radio, `BACK` uses it as it is for now.

---

# Channels and zones

`WHY` the fastest way to set up many channels.




Channels, with a channel's panel

**Read and edit:**

1. Open **Channels & Zones**. Console reads the radio's channels, zones and range presets the first time. **Read from radio** reads them again.
2. Edit in the table: name, RX and TX frequencies, tones, power, zone, skip. **Shift** shows the repeater shift when TX is within 10 MHz of RX ("−600 kHz", "+5 MHz"); type a shift there instead (`+600k`, `-0.6`, `+5M`) and TX follows. A TX further away (crossband, satellites) just shows no shift.
3. Click a channel's number for the side panel: every field, the options (scan skip, priority, APRS, RX only, hidden, busy lockout, reverse) and **Delete channel**. On a wide window it sits beside the table; `Esc` closes it.

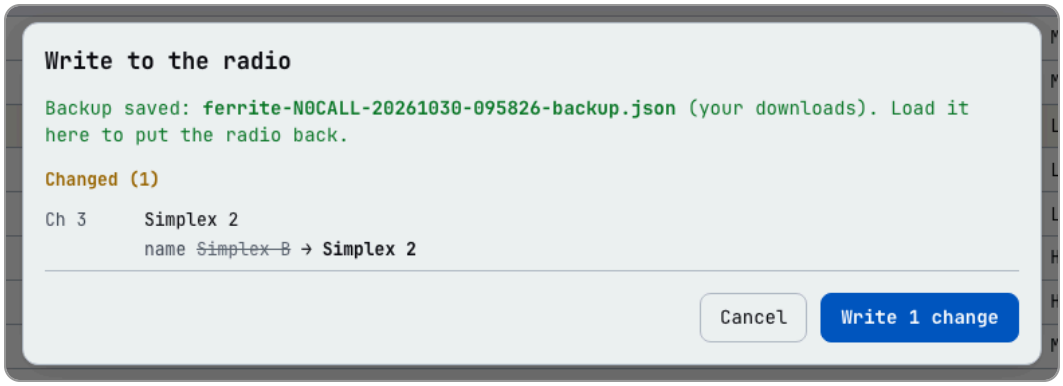
4. **+ Add channel** adds one. **All zones** and **Find** narrow the table.

The radio holds 4,000 channels and 512 zones. A zone holds 256 channels at most: a full zone shows **(full)** in the zone lists, and Console won't put a 257th in it ("Zone 3 Repeaters is full (256 channels at most)"). Moving many at once moves as many as fit and says how many.

- **Position:** in the side panel, type degrees (`45.4215, -75.6972`, north and east positive) or a grid square (`FN25dk`). The radio uses it for Nearby and distances. A 📍 marks a channel with one.
- **Many at once:** tick the rows. The bar above the table sets power, zone, skip or mode for all of them, clears their positions, or deletes them.
- **Undo:** ↶ **Undo**, or `Ctrl+Z` (`⌘Z` on a Mac). A delete can also be undone from the notice.

Changed rows are tinted and new ones are green. The sidebar shows "N unwritten" until you write.

## Write to the radio




The changes, before writing

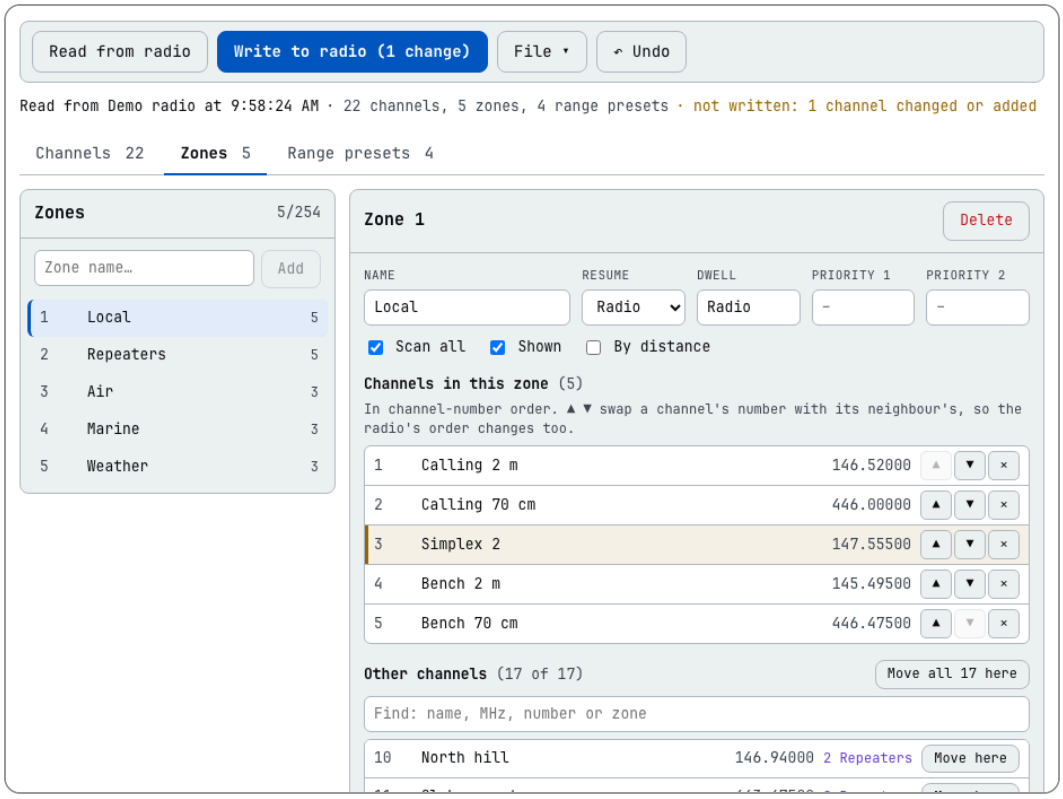
1. Press **Write to radio (N changes)**.
2. Console backs the radio's channels up to a file in your downloads. Open that file later to put them back.
3. It lists every change: added, changed and deleted channels, field by field, and the home channel. Anything the radio would refuse is listed first, to fix.
4. Press **Write N changes**. The radio shows the progress; `BACK` on the radio cancels.
5. Console reads the channels back and says whether the radio holds the table.

Unwritten changes survive closing the page: next time, Console offers **Write** or **Discard**. **File › Discard unwritten changes** puts the table back as it was read.

An older Ferrite can't store positions. Write says so and keeps them in the table; update Ferrite to write them.

## Zones

`WHY` zones group channels, and they are what the radio scans.




The zone editor

1. Open the **Zones** tab. The zones are on the left. Type a name and press **Add** for a new one.
2. Pick a zone. Set its name, resume, dwell, the two priority channels, **Scan all**, **Shown** (in ◂▸ on home) and **By distance**.
3. Its channels are listed in order. **Other channels** below: **Add** one, or **Move here** to take it from its zone. A channel is in one zone at most.
4. × takes a channel out of the zone. **Delete** removes the zone; its channels go to no zone.

▲▼ swap a channel's number with its neighbour's, so the radio's order changes too. The zone's priority channels and the home channel follow the channel to its new number.

## Range presets

The **Range presets** tab edits your own band scans (MENU 0 1 4): name, start and end MHz, step, mode and resume. They are read and written with the channels.

A range can't cross 18 or 64 MHz.

**Skipped frequencies** under each preset are the ones its scan passes over (up to 48). Type one in MHz and press **Skip it**, or `×` to stop skipping one. Each must lie within the range. Write sends them after the presets. A radio on older firmware keeps its own list, and the page says to update Ferrite.

## Import channels

- **CHIRP or RepeaterBook: File › Import CHIRP / RepeaterBook...** takes a CHIRP CSV file. Add them in a new zone, merge by channel number, or replace every channel. RepeaterBook's latitude and longitude become positions. **File › Export CHIRP...** saves the table as CHIRP CSV.
- **Long lists:** more than 256 channels into a new zone go into several, 256 each ("Repeaters 1", "Repeaters 2"...). A merge that would fill a zone past 256 offers **Split them over new zones**. In the library, **Past 256, go on in a new zone** (on to start) does the same; untick it to skip the rest instead.
- **The library: Add from library...** has fixed sets (FRS, GMRS, MURS, PMR446, marine, weather, airband, resource roads, calling) and **Near me**: amateur repeaters, business and public radio (licensed VHF and UHF sites in Canada and the US) and airports (airband, AM, receive only), near a place. Type a place (`49.2827, -123.1207` or a grid square), take the radio's position (asked for when the tab opens), or click **Use my location** (in a browser; the browser asks first), then pick a radius.
- **Near me** opens on a map that fills most of the window; **List** switches to the rows. Under **Near me** in the dialog's sidebar, **Repeaters**, **Business & public** and **Airports** each switch on and off (Repeaters and Business & public are on to start), in any mix (at least one stays on), with how many are near the place beside each. They decide what shows on the map and in the list, and Console remembers them. Clicking one from **Fixed sets** opens Near me with it on. With Business & public shown, its categories sit under it in the sidebar as switches too, and the **Canada** and **US** chips switch each country's sites on and off. A marker is one site, with its number of frequencies; nearby markers group into a count until you zoom in. Click a marker and tick the frequencies you want: they collect under **Picked**, and **Add** takes them, airports as AM, licensed sites in their own mode and repeaters with their shift and tones. Add takes only what is shown, so its count always matches what you see; picks of a hidden kind stay picked for when you show it again. The circle is your search: drag its edge or the **Radius** slider and the results load again. The target button under the map's zoom buttons centres the map on you: the radio's position when one is connected, else this computer's location (in a browser), and brings the view back after you have panned away. Picks are the same in the map and the list; with several kinds on, the list shows the repeaters, then business and public, then the airports. The search box keeps a name, category, airport, callsign or the start of the MHz, on the map and in the list.
- **Business & public** (licensed sites) come from data.ferritefw.dev, a few squares at a time, so Console needs a connection the first time you look at a place. Digital-only licences are left out: Ferrite has no digital modes. Channels are receive only by default and keep the site's position.

- **The Business & public list** sorts by category: public safety first, then transit, utilities, marine, schools and government, and business last. Each category is a switch under **Business & public** in the sidebar, with its count; the map and the list follow them. Business starts off: it is over half the sites, most of the clutter on the map, and one click brings it back. Under each category, a licensee's names are grouped as one organization ("Vancouver, City of" and "City of Vancouver" are the same), nearest first: tick the organization to take all of it, or open it to pick frequencies. Each frequency shows once per organization, from its nearest site, with how many of its sites share it. The filter matches an organization, a category or the start of the MHz.
- **Airports** come from data.ferritefw.dev too (OurAirports, worldwide). Each frequency is named by its use, like `CYVR TWR` or `CYVR ATIS`. Tick the common frequencies to add the **Airband (common)** set as well: 121.5 emergency, air-to-air, multicom and en route frequencies not tied to one airport. The set's notes say which apply in Canada and which in the US.
- **Repeaters** come from data.ferritefw.dev too: HearHam's user-contributed list (worldwide), keeping operational repeaters that pass analog FM on 2 m, 1.25 m and 70 cm. Each frequency shows its offset and tones: `T 100.0` is the tone to send, `TSQL 100.0` the same tone both ways, `R` one the repeater sends. **Add** makes a channel named by the callsign that receives on the output and transmits on the input (the offset), with the tones as listed (none received when HearHam gives none), in NFM where HearHam says so, else by the region's band plan (FM in the Americas and Asia-Pacific, NFM in Europe and Africa). They go in one **Repeaters** zone and keep the repeater's position. Listings are user-contributed: check one before relying on it.
- **Save … for offline** (at the bottom of Near me) downloads a whole country once (or every airport or repeater, about 0.25 MB each), with its size shown first. When newer data is published, the tab offers **Update channel data**; nothing downloads by itself.

Imported channels go into the table only. Nothing reaches the radio until **Write**.

---

# Save and open a codeplug file

`WHY` keep a copy, move a setup to another radio, or share it with your club.

- **File › Save as…** saves one `.ferrite` file: the channels and zones (with positions), the range presets (with their skipped frequencies), Radio Settings, APRS settings, contacts, quick messages, waypoints and DTMF memories, whatever Console has read or opened, unwritten changes included. It is named with your callsign and the date.
- **File › Open…** loads a `.ferrite` file (or an older Console `.json` backup). Each part opens as unwritten changes on its page. Write each page to put it on the radio. A file from before November 2026 with a zone of more than 256 channels opens with that zone split ("Repeaters 2" takes the rest); the notice says so, and **Undo** puts it back.

- **File › Back up radio...** reads the radio afresh into a `.ferrite`, leaving the table alone.

A codeplug never holds the PIN or the radio's ID, so it is safe to share. Opening one keeps the radio's own PIN.

---

# Radio settings

`WHY` see every setting at once, by menu number.

1. Open **Radio Settings**, then press **Read from radio**.
2. The settings are grouped as in the radio's menu, with the menu numbers (`0` `1` `4` is `MENU` `0` `1` `4`). **Find a setting** searches them.
3. Change a setting.
4. Press **Write to radio...**. As with channels: a backup file, the list of changes, then the write and a read back. **Undo edits** goes back to what was read.

Some settings change only on the radio, and each says why:

- Region and Extend TX, for safety: they decide where the radio may transmit.
- The PIN lock and channel-only mode: the PIN never goes over the link.
- The cable port and KISS: changing them would cut Console's own connection.

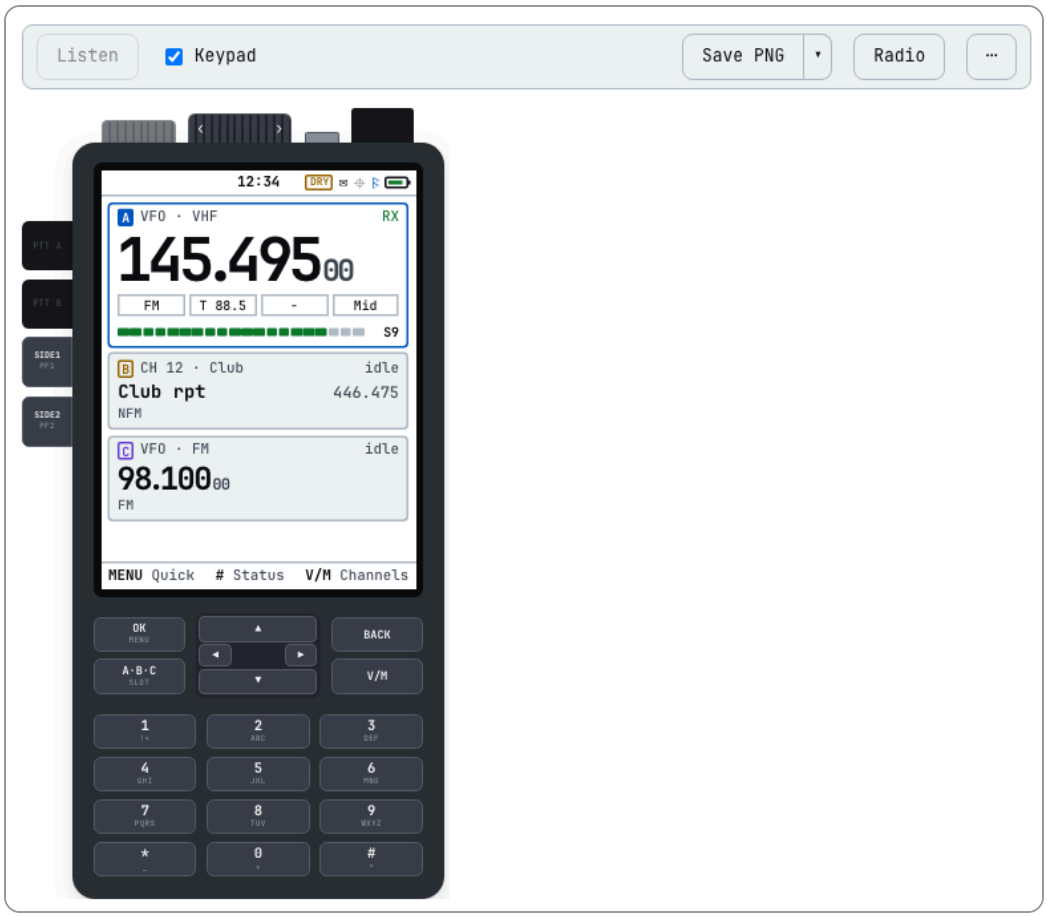
The **Crossband repeater** group holds the repeater's sides, power, timeout, hang time, tone gate, ID and speaker, as on its start page (`MENU` `0` `3` `4`). The repeater itself starts only on the radio.

> ## DTMF memories
>
> The **DTMF memories** tab holds the dialer's 16 memories. Each has symbols (1 to 16 of `0-9`, `A-D`, `*`, `#`) and a name of up to 10 characters, such as `*79#` "Link on". **Clear** empties one. Write them with **Write to radio**, as the channels are. The dialer's speed and delays are settings (`MENU` `0` `8` `5`).

---

# Live View

`WHY` use the radio from the computer, or show it to someone.




Live View

- The radio's screen and keys. Click a key; hold it for a long press. The knob turns with the mouse wheel. Untick **Keypad** for the screen alone.
- Keyboard: digits, `Enter` or `M` for MENU, `Esc` for BACK, the arrows, `,` and `.` for `*` and `#`, `S` for ABC, `V` for V/M, `Q` and `W` for SIDE1 and SIDE2, `[` and `]` for the knob. Shift with a key is a long press. **?** (the button, or the `?` key) lists them. The keys go to the radio except while you type in a box or a dialog is open.
- Live View never transmits: there is no PTT.
- **Listen** (cable only) plays what the radio receives on the computer, with volume and mute. It shows which slot you hear. It is off each time you connect.
- The dot by Listen is green while no audio is lost. It turns amber when the radio dropped blocks, or the playback had gaps, in the last 10 s. Hover it for the count.
- **Record** (while listening) saves what you hear as a WAV file, 12 kHz mono. Quiet stretches are kept as silence, so the file keeps time. It shows the time and size; ■ **Stop** saves it. It stops by itself at 60 minutes.
- **Tune from map** opens the Near me map. Click a repeater, a business or public frequency, or an airport's: the radio's active slot tunes to it as a VFO frequency, and the map closes. A repeater brings its shift and tones; an airport tunes in AM. Nothing is saved as a channel. It needs a connected radio. The target button centres this map on you too.
- **Recent** lists the last 10 frequencies you tuned from the map, kept on this computer. Click one to tune it again. **Add as channel** puts it in the channel table, green until

you write.

- **Save PNG** saves the screen at 240 × 320. `▾` beside it saves at twice the size, or copies it.
- **Radio** shows the radio's details.
- **The side panel:** on a window at least 1200 px wide, with room for the radio beside it, a panel shows the slots (frequency or name, mode, tone, power, receiving or scanning), **Heard now** (APRS stations and new events from the event log as they arrive), the radio's battery, GPS and Bluetooth, and Listen. The **Panel** switch hides it.
- **⋯ › Send a key sequence...** presses a list of keys for you, such as `MENU` `0` `7` `1`. Write a long press as `MENU:long`.

Over the cable the screen updates several times a second, over Bluetooth about once a second.

---

# APRS

`WHY` read and send APRS messages and see who's around, on a big screen.

- **Messages:** one conversation per station. **New message**, type the callsign-SSID and the text (up to 67 characters), then **Send**. The radio sends it by its own rules: at once if APRS mode is on, otherwise when you turn it on. Each message shows its state: pending, retrying, acked or failed. **Stop sending** ends the retries; **Delete** removes a message on the radio, after you confirm.
- **Heard stations:** who the radio heard, with distance (when the radio knows its position), symbol, comment and the time. **Find a station** searches them.
- **Quick messages:** the nine texts the radio's compose offers. Edit one to make it yours (up to 67 characters, none of `|`, `~`, `{`), or **Back to the factory text**. Write them with **Write to radio**.
- **Map:** the stations heard with a position, and your own, on OpenStreetMap. The radio's waypoints show as diamonds; untick **Waypoints** to hide them.
- **Waypoints:** the places the radio keeps, newest first (up to 256). **+ Add** puts a new one on top. Type its position as degrees (`49.2827, -123.1207`) or a grid square (`CN89lg`). Each shows where it came from (marked on the radio, an APRS station, Console or a grid square). **Map** shows it on the map. Write them with **Write to radio**.
- **Contacts:** the radio's address book, up to 128. Add, rename or delete: each change is written at once. **Import CSV...** (callsign,name lines) adds many; press **Write to radio** to keep them. **Save CSV** exports them.
- **Settings:** the APRS menu (`MENU` `0` `5`): beacon, path, symbol, comment and the rest. Read and written as Radio Settings are.

## Satellites

`WHY` put the satellites you want to work on the radio, with fresh orbits, and keep them fresh.

1. Open **Satellites**. Console loads the list from data.ferritefw.dev: the satellites a 2 m / 70 cm FM handheld can work (orbits from CelesTrak, transponders from SatNOGS DB). It keeps a copy for when you're offline.
2. Each row shows the satellite, its status, its transponders (downlink, uplink, tone) and the age of its orbit elements: amber past 7 days (3 for the ISS), red past 30.
3. Tick the ones you want, up to 32. Every active satellite is ticked to start; **Active** and **None** pick them all or none.
4. Press **Write to radio**. Console sets the radio's clock, replaces its satellite list, and writes the magnetic declination at the radio's position (its GPS fix, its fixed position, or the place set in Near me), so the pointing page can give a compass bearing.

**On the radio** shows what the radio holds, its declination, when the list was written and its clock. Writing again keeps each satellite's own settings (trim, FD or HD, transponder, power).

**Keep satellites up to date** (on to start): each time you connect, if the radio holds satellites and the list online is newer, Console writes the same satellites again with fresh orbits, the declination and the clock. It doesn't ask. A note at the bottom says when it did. It does this at most once a day, and never for a radio with no satellites: you pick them first.

---

## Event log, terminal and theme

- **Event Log** (under More): what the radio's event log holds (APRS, pager, weather alerts, DSC, AIS, DTMF, Selcall, GPS), newest first. New events appear as they happen. Filter by source, search, see a position on the map, or **Export CSV**. Reading it here doesn't mark anything read on the radio.

Quick messages, waypoints, DTMF memories, skipped frequencies and live events need the current Ferrite. On an older radio Console says to update it. The sidebar shows how many changes in each section aren't written yet.

- **Terminal** (under More): the radio's command line, for advanced use. Type `help` for its commands.
- **Theme:** the icon at the top right picks ☀ Light, ☾ Dark or ◐ Auto (follows your computer).

CHAPTER 11

# Key card and menu map

## Keys on home

| KEY | PRESS | HOLD |
|---|---|---|
| MENU | Quick settings | The full menu |
| BACK | Back one step | Home, from anywhere |
| Knob, ▲▼ | Tune, or step channels | — |
| ◀▶ | Channel: zone. VFO: band | — |
| ABC | Next slot, A → B → C | Edit the slot |
| V/M | VFO or channels | The zone list |
| SIDE1 | Monitor on or off | Monitor while held. With the knob: squelch |
| SIDE2 | Scan start or stop | Frequency counter. With the knob: big steps |
| * | Mute or unmute the slot. Twice quickly: slot off | The quick menu |
| # | Help (or pause watch) | Lock or unlock the keys (then * all, 0 all but PTT) |
| Digits | Type a frequency or channel | A shortcut (below) |
| PTT A | Transmit on the active slot | — |
| PTT B | Transmit on slot B | — |
| PTT + SIDE2 | 1750 Hz tone burst | — |
| SIDE1 + SIDE2 | — | Leave Low Power Mode |

## Hold a digit on home

| HOLD | DOES | HOLD | DOES |
|---|---|---|---|
| 0 | Home channel | 5 | Tone picker |
| 1 | Band scope | 6 | Next step size (VFO) |
| 2 | TX power: low, mid, high | 7 | Shift: simplex, +, – |
| 3 | Squelch | 8 | Offset amount |
| 4 | Watch on or off | 9 | Save the VFO as a channel, or copy a channel to the VFO |

On a channel, hold 7 and hold 8 open the channel's editor.

## The quick menu (hold *)

| THEN | DOES |
|---|---|
| Knob | Brightness |
| PTT A | Reverse on or off |
| PTT B | Night red on or off |
| SIDE1 | GPS: Off, Auto or On |
| SIDE2 | Bluetooth on or off |

## On the APRS slot

With APRS mode on and slot C active:

| KEY | DOES |
|---|---|
| OK | The APRS list: 1 Messages, 2 Heard, 3 Sent, 4 Beacon now ... |
| hold V/M | Send a beacon now |
| PTT A | A new message |

| KEY | DOES |
| --- | --- |
| * | Mute or unmute C |
| hold 2 | Beacon power |

## Quick settings (MENU)

| | | | |
| --- | --- | --- | --- |
| 1 | Squelch | 6 | Step (VFO) |
| 2 | TX power | 7 | Watch |
| 3 | Mode | 8 | Save or edit the channel |
| 4 | Tones | 9 | Battery Save |
| 5 | Offset | 0 | The full menu |

## In lists and settings

| KEY | DOES |
| --- | --- |
| ▲▼ | Move |
| Knob, ◀▶ | Change the value (it applies at once) |
| OK | Open, or a bigger editor |
| # | Back to the default |
| * | Undo, for 5 seconds |
| BACK | Back one level |
| PTT | Keep the change, go home and transmit |

**Typing text** (names, callsigns, messages): press a digit several times for its letters. * is a space and # changes upper case, lower case and symbols, as the keys are marked. 1 has . - / @ before its digit; in a callsign only - (your own callsign: - and /). In a message, # also reaches T9, typing word by word. BACK deletes.

# Menu map

From home: MENU 0, then the digits. hold MENU is the same as MENU 0.

**1 Watch and scan**

- 1 Watch · 2 Resume · 3 Priority check · 4 Range presets · 5 Skip list
- 6 Advanced: 1 Pause time · 2 Direction · 3 Scan inputs · 4 Return to

**2 Channels**

- 1 Browse · 2 Add repeater · 3 Zones · 4 Channel shows · 5 Local zone
- 6 FM broadcast: 1 Step · 2 AGC · 3 Radio monitor · 4 Sleep timer

**3 Tools**

- 1 Band scope (its settings; 6 opens it) · 2 Frequency counter · 3 HF mode · 4 Crossband repeater · 5 Tone search · 6 Satellites

**4 Decoders and alerts**

- 1 Event log · 2 POCSAG · 3 DTMF decode · 4 Popups
- 5 Weather alerts: 1 SAME · 2 Location codes

**5 APRS**

- 1 Heard · 2 Messages · 3 APRS mode · 4 Frequency
- 5 My station: 1 SSID · 2 Symbol · 3 Comment · 4 Position source · 5 Fixed position · 6 Ambiguity · 7 Mic-E
- 6 Beacon: 1 Mode · 2 After voice TX · 3 Power · 4 Telemetry
- 7 Digipeat: 1 Digipeat · 2 Aliases · 3 Wait
- 8 KISS TNC
- 9 Advanced: 1 Path · 2 Custom path · 3 TX delay · 4 TX level · 5 FX.25 · 6 Mute speaker · 7 Shared VHF (APRS first or A·B first)

**6 GPS and time**

- 1 GPS (Off, Auto, On) · 2 Position · 3 Coordinates · 4 Units · 5 Time zone · 6 Clock · 7 Waypoints · 8 GPS off during · 9 Fixed position

**7 Display, sound, power**

- 1 Theme · 2 Layout
- 3 Display: 1 S-meter · 2 Power-on text · 3 Boot screen
- 4 Backlight: 1 Timeout · 2 Brightness · 3 On transmit · 4 Wake on · 5 Key light
- 5 Sounds: 1 Key beep · 2 Beep volume · 3 Alert tones · 4 Arrival tone · 5 Message sound · 6 Message volume
- 6 LEDs
- 7 Power saving: 1 Battery Save · 2 Low Power Mode · 3 Auto below
- 8 Auto power off · 9 Menu timeout

**8 Transmit**

- 1 Timeout
- 2 VOX: 1 VOX · 2 Level · 3 Tail
- 3 Mic gain · 4 End tone
- 5 DTMF: 1 Dialer · 2 Memories · 3 Speed · 4 Sidetone · 5 Start delay
- 6 Callsign and ID: 1 Callsign · 2 CW ID
- 7 Busy lockout default
- 8 Advanced: 1 Subtone level · 2 Tail removal · 3 Phase · 4 Extend TX · 5 Dry TX
  (bench tests: keys with no power out)

**9 System**

- 1 Keys and lock: 1 Auto lock · 2 Key test · 3 Shortcuts
- 2 Connections: 1 Bluetooth · 2 Link status · 3 Cable port
- 3 PIN and lock: 1 PIN lock · 2 Channel-only mode · 3 Change PIN
- 4 Region · 5 Squelch (Software or Chip) · 6 SSB patch
- 7 Setup and reset: 1 Run setup again · 2 Reset
- 8 About
- 9 Advanced: 1 Advanced squelch · 2 Calibration · 3 Cable log · 4 Terminal colour · 5 MCU clock

MENU 0 0 opens the Status page.

CHAPTER 12

# Known issues and reporting a problem

Ferrite is an early release: most things work every day on our own radios, some don't yet, and your reports decide what we fix first.

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## Known issues

**Radio:**

- HF receive audio (AM) is still being worked on: levels may change. SSB and CW aren't built yet.
- Some early boards can't hear medium or long wave. That is a hardware fault, not Ferrite.
- APRS mode uses more battery than plain receive: the decoder stays awake.
- English only.

**Ferrite Console:**

- The cable needs Chrome, Edge or Firefox on a computer, or the desktop app; Bluetooth needs Chrome or Edge. Safari can't reach either.
- The install's backup takes about 4 minutes. Keep the cable in and the radio on until it says done.
- Range presets' skipped frequencies can't be seen or edited in Console yet.
- If a backup or install stops part way, plug the cable straight into the computer and try again. Long USB extensions and some hubs lose data on long transfers.

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## Get help

Questions, how-tos and "is this normal?": ask on the Ferrite Discord, discord.gg/fYygBVD2Kx. Problems that need fixing go on the issue tracker, below, so they don't get lost in the chat.

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## Report a problem

WHY a good report gets fixed quickly. Two minutes now saves a lot of guessing.

1. Note the version: MENU 0 9 8 (About). A photo of the About page is perfect.
2. Write what you did, key by key if you can (MENU 0 5 3, hold ABC, ...).
3. Write what you expected, and what happened instead.
4. Add a photo or a short video of the screen, if it shows the problem.

5. Say whether it happens every time, sometimes, or once.
6. Open an issue on Ferrite's GitHub issue tracker, github.com/FerriteFW/ferrite/issues, with the above. One problem per issue.

**If the radio froze:** note what was on the screen, then turn it off and on. If it doesn't start, see Go back to the original firmware and tell us.

**Never send:** your backup file. It holds your radio's calibration and your channels, and we don't need it.

CHAPTER 13

# Field notes

How Ferrite works inside the radio, and why it behaves the way it does. You don't need any of this to use the radio. It helps when something surprises you, such as one slot hearing better than another.

## Two receivers, two jobs

The radio has two transceiver chips. Each one tunes one frequency at a time.

| CHIP | COVERS |
|---|---|
| Chip 0 | 64 to 300 MHz: 2 m, 1.25 m, VHF airband and marine |
| Chip 1 | Below 64 MHz, and 300 MHz and up: HF, 6 m, 70 cm, UHF |

A third chip handles broadcast FM, AM and shortwave on its own. That's why FM broadcast can play while the radio still watches your slots.

Which chip a slot uses depends only on its frequency. A slot on 146.520 always uses chip 0. A slot on 446.000 always uses chip 1.

## One antenna, one way in at a time

Both chips share the antenna. A splitter divides the signal by band, and each band has its own small amplifier in front of its chip. The firmware switches on the amplifier for the band it wants to hear.

The radio is built to have **one receive path on at a time**. So even with both chips awake, only the chip whose path is on is really listening. This is the main limit behind everything below.

Transmit is different: the crossband repeater listens on one band while it transmits on the other. Each chip does one job, and both paths are on together.

## How watch shares time

With watch on, the radio takes turns. Each slot gets the receive path for a moment:

- The active slot's turn is 150 ms.
- A watched slot's turn is 70 ms.
- A slot that hears a signal keeps the path until the signal ends.
- A slot turned off (<kbd>*</kbd><kbd>*</kbd>) takes no turns at all.

Two slots on **different chips** switch fast: each chip stays tuned, and only the path changes. Two slots on the **same chip** take longer: the chip has to retune and settle before it can hear.

**Tip:** to watch two frequencies well, put them on different chips, such as one on 2 m and one on 70 cm.

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# APRS mode

APRS packets are short, about half a second. A packet that starts while the radio listens elsewhere can be missed. So in APRS mode, slot C comes first:

- When C is alone on its chip (A and B on 70 cm, say), C gets the receive path every other turn, for 100 ms, and the active slot's turn drops to 70 ms. The cycle is A, C, B, C: C hears about 60 % of the time and is never deaf for more than 70 ms.
- When A or B shares C's chip (both on 2 m), the chip has to retune for each turn. With **APRS first** (MENU 0 5 9 7, the default) C gets 400 ms turns and the other slots 100 ms looks: C hears about three quarters of the time. **A·B first** gives A and B their usual turns instead, and C misses more.
- A slot that hears a signal keeps the path until the signal ends, so a voice call on A still holds C off until it's over.
- After the radio sends a beacon or message, C keeps the chip for a second, so the digipeater's repeat or the other station's ack is heard from its start. Data transmissions also drop the carrier at once, with no tail.
- After you talk on A or B, watch pauses for 30 seconds, but C keeps listening.
- C's chip is set up for data, not voice: two of the filters that shape voice are off on the APRS slot, which helps the decoder.

**Tips for the best APRS reception:**

- Put C on a different chip from the slots you watch: A and B on 70 cm.
- Turn a slot you don't need off (* *): its turns go to C.
- Keep A and B quiet, or turn watch off, when APRS matters most.

**What's next:** the hardware may allow both receive paths on at the same time. If it does, C could listen all the time while A and B still take turns. We're testing whether reception stays as good with both on before we turn it on.

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# Squelch: two ways to decide

Each chip can decide squelch by itself. Ferrite can also decide from the chip's signal and noise readings, which opens faster and shuts the moment a station unkeys.

- Voice slots use Ferrite's squelch.
- The APRS slot uses the chip's squelch. It holds through a noisy moment, so a packet reaches the decoder whole instead of losing its end.

- MENU 0 9 5 set to **Chip** uses the chip's squelch everywhere.

The decoders listen to the same audio as the speaker. When squelch shuts, they stop hearing too. That's why DTMF digits only count while squelch is open: noise can look like a digit.

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# Sleep and speed

Most of the time, the radio waits for a signal. Two things save battery while it waits:

- **Battery Save** puts the receivers to sleep between short checks (MENU 9). Watched slots follow the same cycle.
- **Dynamic clocking** runs the processor slowly while nothing needs speed, and at full speed for keys, APRS, transmit and connections.

APRS mode keeps the decoder and C's chip awake, so it uses more battery than plain receive.