What’s New With FreeDV

(Since 2025)

Mooneer Salem K6AQ

Who am I?

Why listen to me?

- One of the maintainers of the FreeDV project
  - Been committing to the repos since 2019
- Licensed as a ham for a bit
  - KG6AOV initially, then K6AQ
- Do a lot of C++ stuff for my day job too

What we’re going to talk about today

What you’ll get out of listening

- What is FreeDV, exactly?
- What does it provide over just using SSB
- How do I get started?
- How is it going to be even better?

What is FreeDV?

What's in it for me?

- Easy to use digital voice on HF
  - Optimized for HF band conditions
  - Windows/Linux/macOS application available for download
  - Module available for Flex 8000/Aurora series (no SW required)
  - If you're able to use FT8 and Zoom, you have everything you need

Why would I want DV on HF?

Does it really help that much?

- Less bandwidth than a similar analog signal
  - Many digital voice modes cut this in half or potentially more
  - Smaller bandwidth => higher power density => lower minimum SNR
- Digitization of received signal inherently adds some noise immunity
  - Forward error correction can potentially fix significant issues (with various tradeoffs)

Why don’t I hear DV on HF more?

It’s a hard problem

- Limited competition
  - D-Star, C4FM/System Fusion (unconfirmed, 10M+ only?)
  - Expensive external devices (ARD9800)

Why don’t I hear DV on HF more?

It’s a hard problem

- Most competitors were designed for VHF/UHF
  - Wide bandwidth (ex: ~6 kHz for D-Star)
  - Optimized for VHF/UHF propagation
- HF options (ARD9800) use older codec/modem technology
  - Audio doesn’t sound the best

Wait, doesn’t FreeDV use older technology?

Not anymore

- FreeDV has actually been around since the 2010s
  - Originally used older Codec2 library at low bit rate
  - Used to have the robot sound too
  - Had multiple modes for different HF band conditions (bad for UX)

Bringing AI into the picture

Introducing “Radio Autoencoder” (RADE)

- Newer FreeDV mode introduced in 2024
  - Uses machine learning to encode/decode signal
  - FARGAN codec (Opus) provides speech generation
  - Rapidly superseded all other FreeDV modes

Is it really that much better?

Listen and find out

- RADE vs. SSB (low SNR)
  - SSB signal fairly noisy but RADE 100% intelligible
  - Test performed August 2024 (https://freedv.org/davids-freedv-update-september-2024/)
  - 25 watts (peak, including SSB compression) from Texas to Australia

How do I get started?

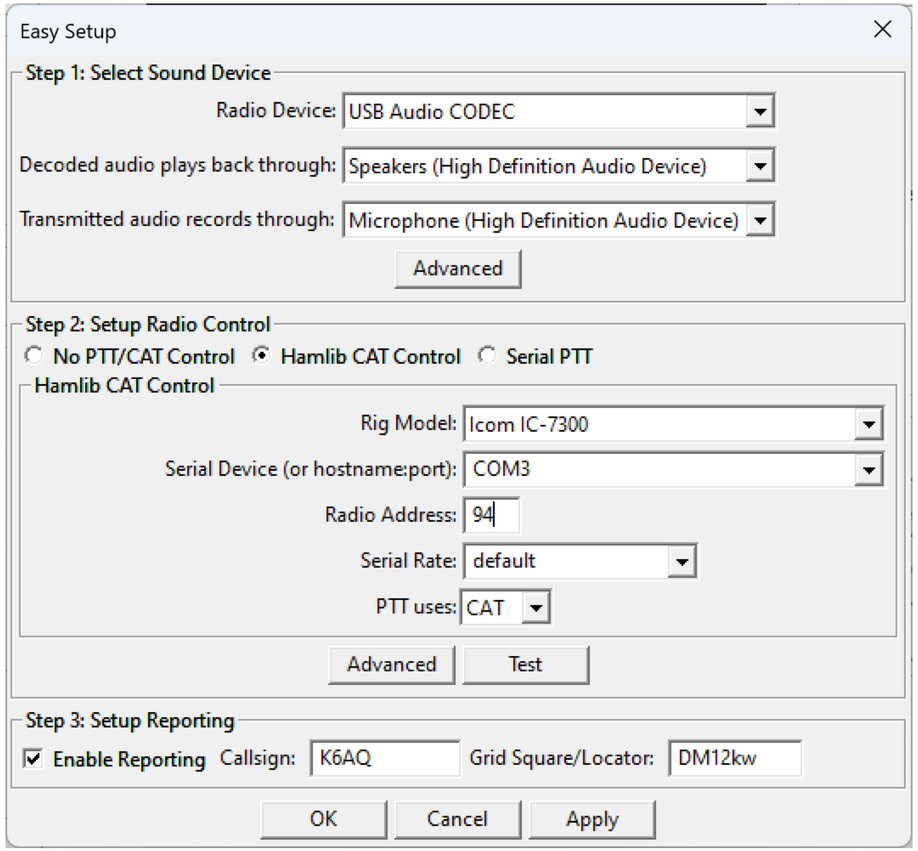
You've sold me on it

- FreeDV client application
  - Available at https://freedv.org/
  - Binaries for Windows (32/64 bit) as well as Mac (Intel/ARM)
  - Source code on GitHub

How do I get started?

You've sold me on it

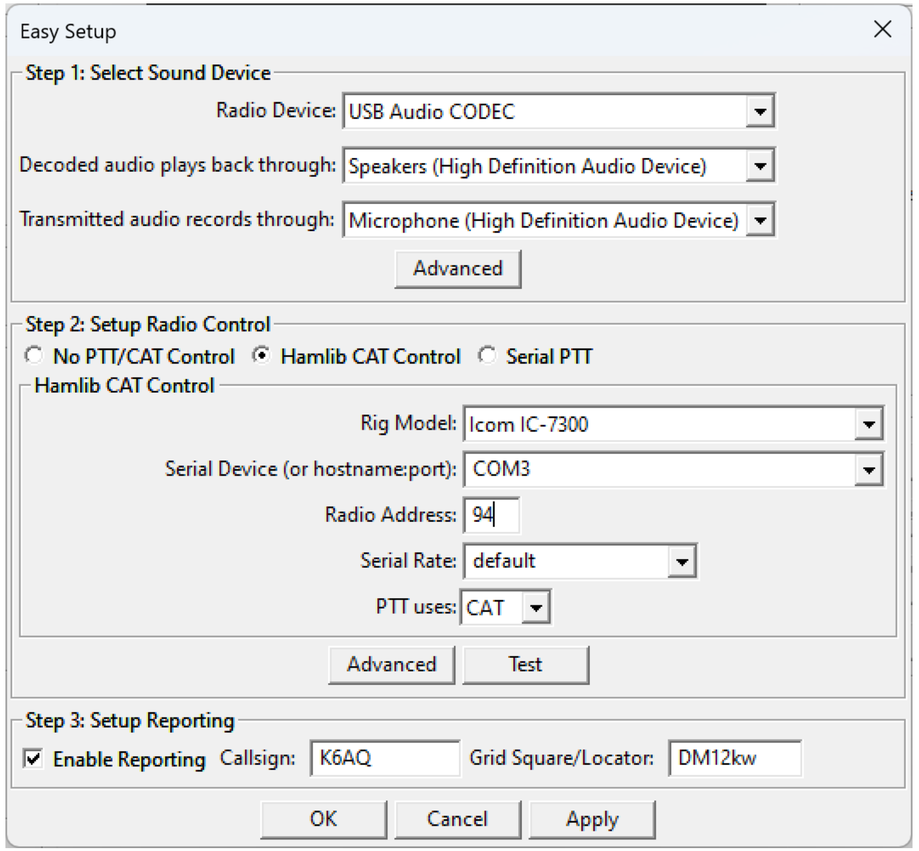
- Audio device selection
  - Radio Device: the device you use for FT8/ other digital modes
  - Decoded audio/Transmitted audio: The same headset/mic/speaker you use for Zoom
- Advanced button for more involved setups



How do I get started?

You've sold me on it

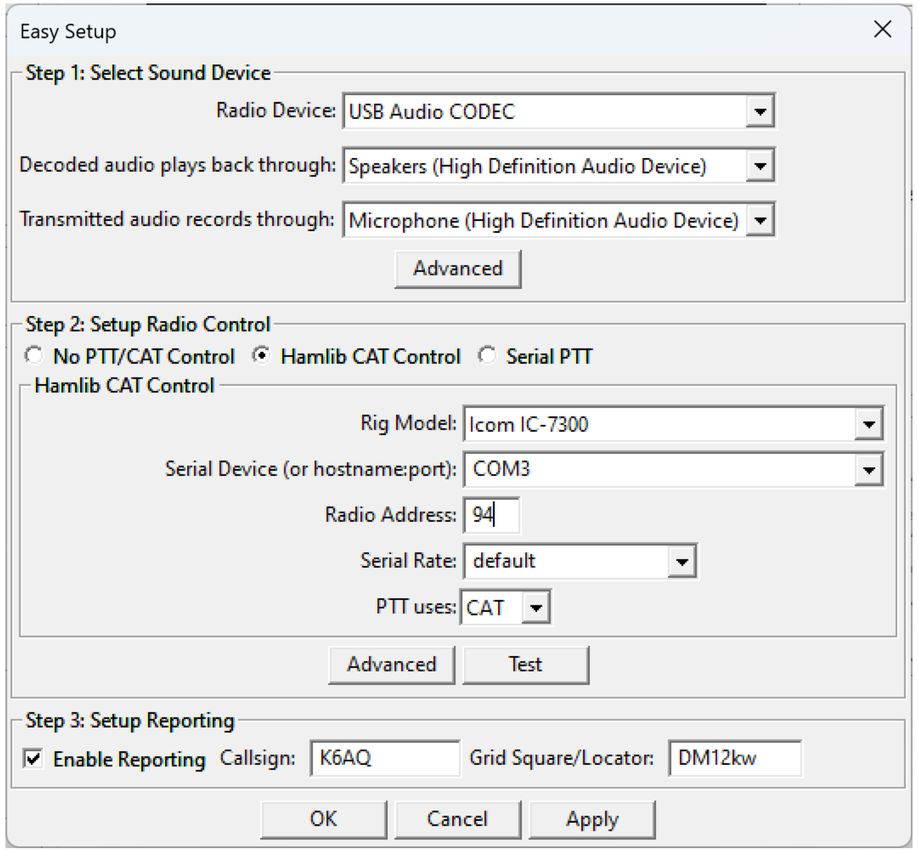
- CAT control
  - FreeDV supports Hamlib/OmniRig/serial PTT
  - Setup similar to other digital apps (COM port, etc.)



How do I get started?

You've sold me on it

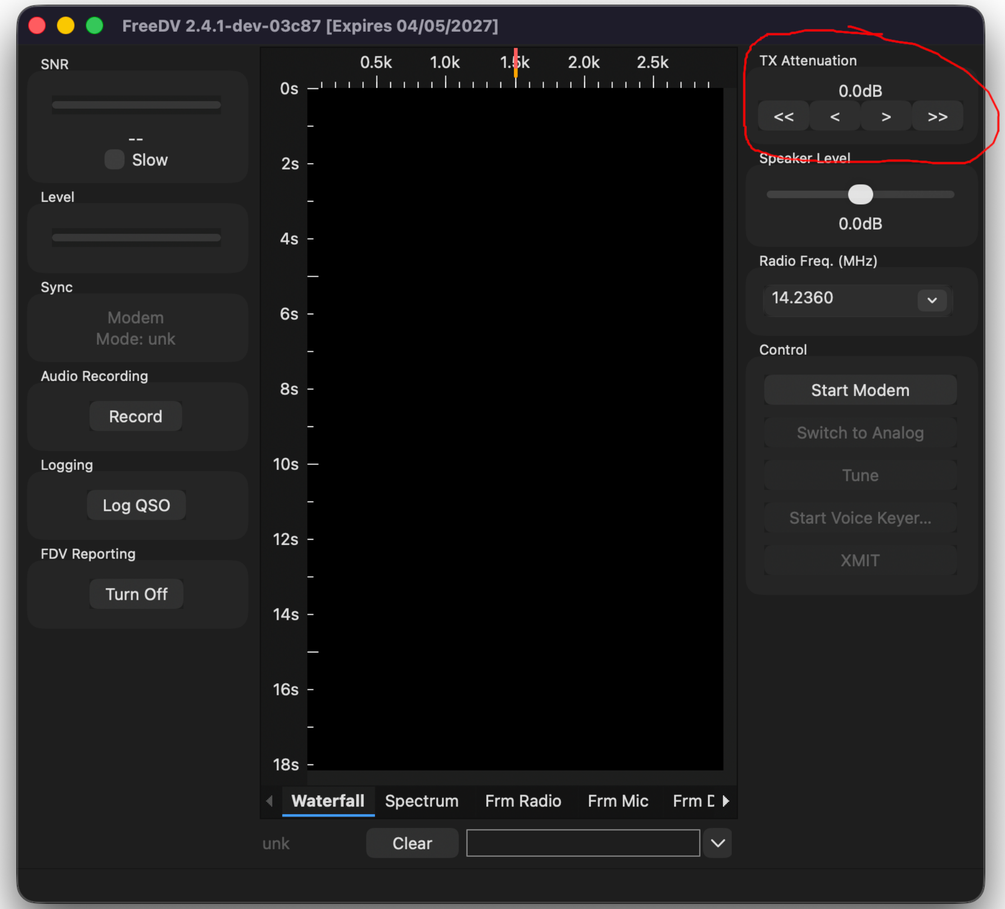
- Reporting
  - Enter your callsign and grid square
  - Highly recommended for spotting



Adjusting drive levels

Don’t just turn it to 11

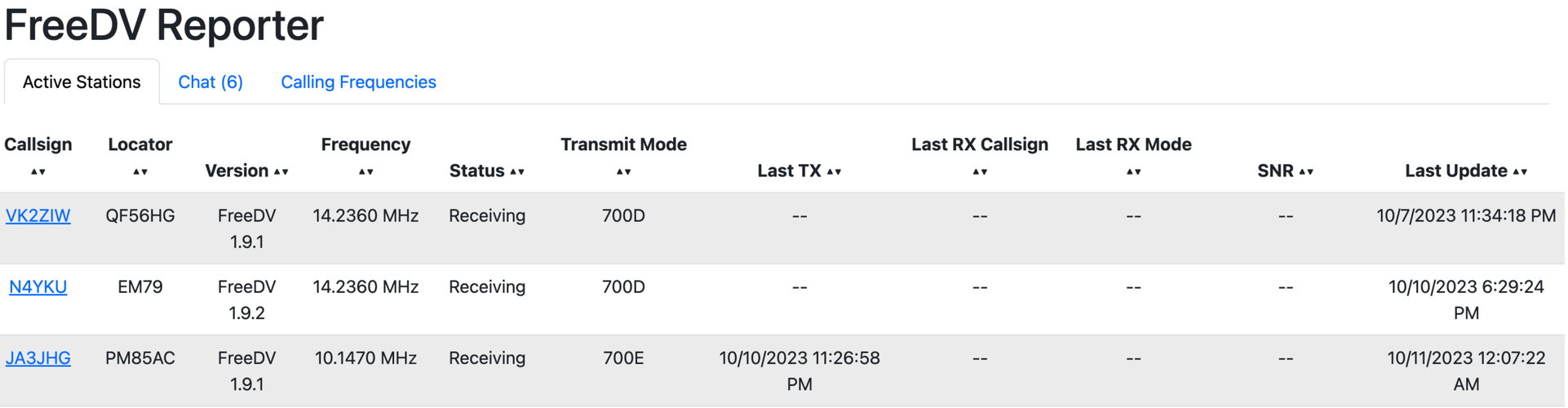
- Same rules apply as with other digital modes
  - ALC generally should not indicate on your radio during TX
  - Use TX Attenuation slider to dial back power output as needed
- Overdriving your microphone reduces audio quality on the other end
  - Use Windows, etc. audio settings to adjust



Where’s everyone?

How do I find someone to talk to?

- FreeDV Reporter: https://qso.freedv.org/
  - Live TX/RX status of stations using the FreeDV application
  - Chatroom style interface to allow of live coordination with other users



FreeDV Reporter

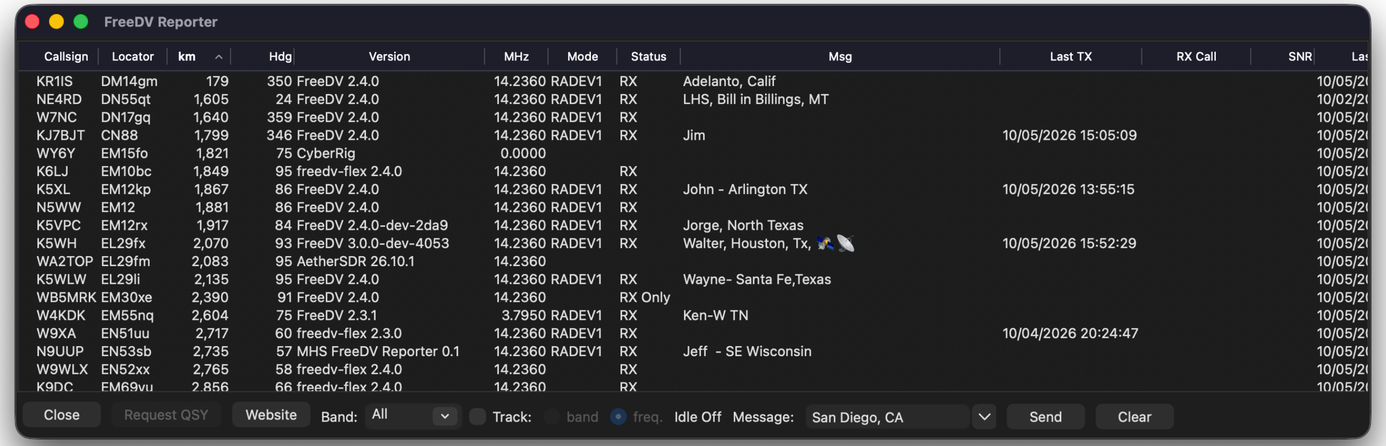
Active Stations | Chat (6) | Calling Frequencies

Callsign	Locator	Version	Frequency	Status	Transmit Mode	Last TX	Last RX Callsign	Last RX Mode	SNR	Last Update
VK2ZIW	QF56HG	FreeDV 1.9.1	14.2360 MHz	Receiving	700D	--	--	--	--	10/7/2023 11:34:18 PM
N4YKU	EM79	FreeDV 1.9.2	14.2360 MHz	Receiving	700D	--	--	--	--	10/10/2023 6:29:24 PM
JA3JHG	PM85AC	FreeDV 1.9.1	10.1470 MHz	Receiving	700E	10/10/2023 11:26:58 PM	--	--	--	10/11/2023 12:07:22 AM

Do I really need a browser open?

The call is coming from inside the house

- FreeDV Reporter also available in FreeDV itself (Tools->FreeDV Reporter)
- Contains most of the same features and then some
  - Added filtering/sorting options, user reporting message
  - Request QSY to get people onto your frequency



Where’s everyone?

How do I find someone to talk to?

- FreeDV Activity Day
  - Third weekend of every month (both Saturday and Sunday)
  - 12AM Pacific (0800Z) - 11:59PM Pacific (0759Z)
  - Not a contest! Just a time for people to get together on the air

Where’s everyone?

How do I find someone to talk to?

- Eastern US FreeDV Net
  - Tuesdays 9pm Eastern time @ 7.182 MHz LSB
  - Now up to >60 weekly check-ins and growing :)
  - Reachable from Western US depending on band conditions
- Other nets for various countries, etc. listed on freedv.org

I’m ready for my first contact

How do I talk to people?

- Press Start button in main window
  - Waterfall display will start rendering and audio will come through
- Press and release PTT button to start transmitting
  - Press/release again to stop transmitting and start receiving again
- Press Stop to stop receiving

You mentioned something for Flex?

No software required*

- FreeDV runs on the radio itself if you use a Flex 8000 or Aurora series
  - External Pi4 or newer and your 6000 can join too
- Download Docker container or FlexRadio AppImage from freedv.org
  - (8000/Aurora) Upload to radio using SmartSDR
  - (6000) Run AppImage on Raspberry Pi
- Shows up as a new mode in SmartSDR, operate just like SSB

Are other radios getting this?

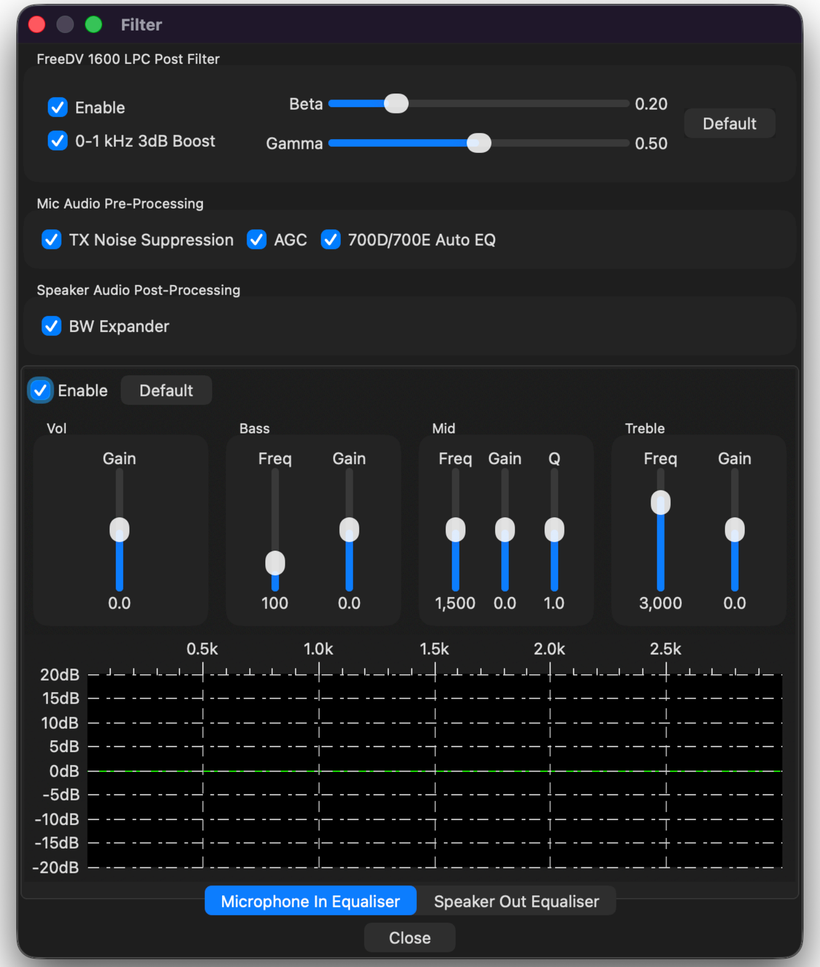
Third party integrations with FreeDV

- Other developers are integrating FreeDV into their own products
  - Ex: AetherSDR (Linux FlexRadio client)
  - Made possible with a full C library of RADE
- We can help if you want your radio to have FreeDV in it
  - See me afterward :)

New features since last year

More stuff to try

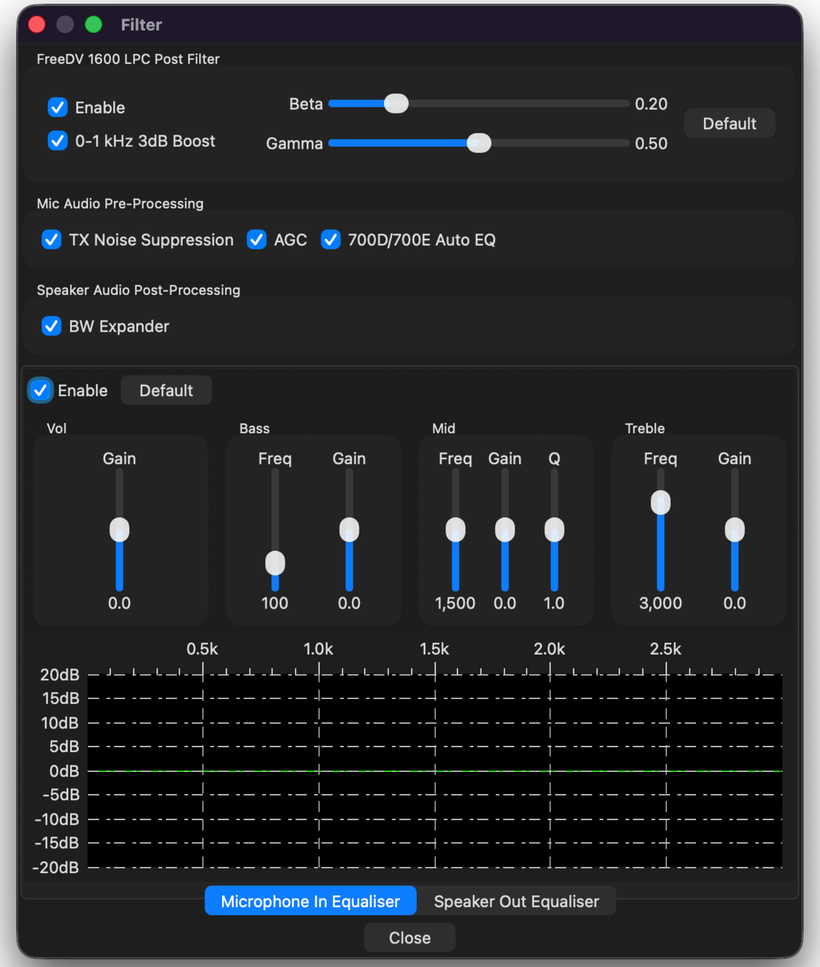
- Bandwidth expander
  - Adds high frequency content back to decoded RADE audio
  - Improves intelligibility (depending on your hearing :)



New features since last year

More stuff to try

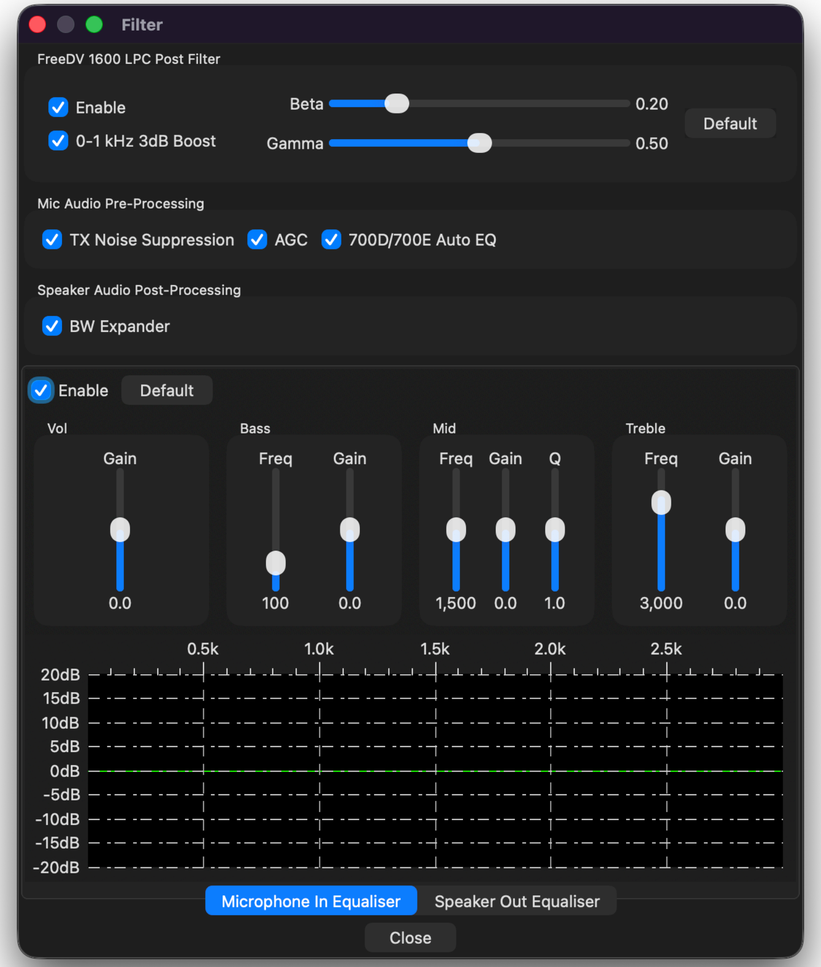
- RNNoise noise reduction
  - Replaces speexdsp based noise reduction
  - Uses machine learning techniques just like RADE
  - More info: https://arxiv.org/pdf/1709.08243



New features since last year

More stuff to try

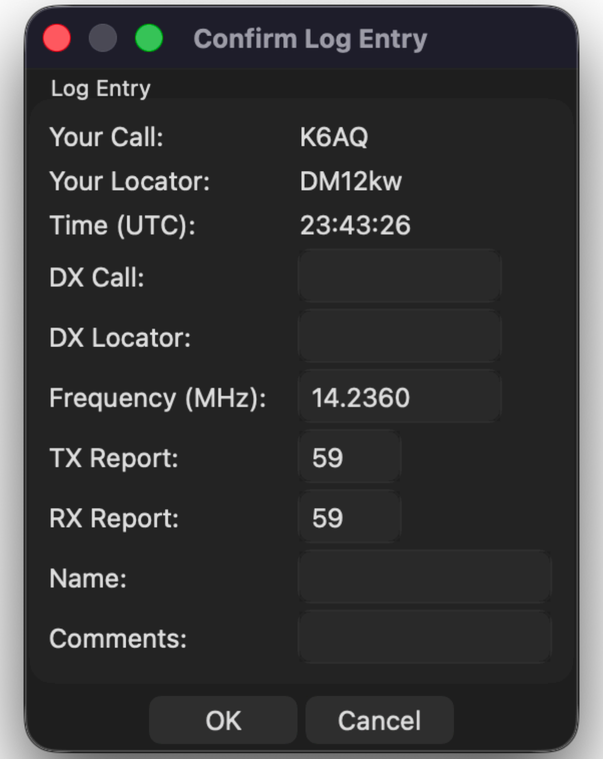
- Automatic Gain Control (AGC)
  - Helps get your microphone levels close to ideal for RADE
- Does not replace making sure your input levels are close to correct in the first place
  - If you’re clipping going into FreeDV, you’ll still sound bad on the other end



New features since last year

More stuff to try

- FreeDV now supports logging
  - Sends network packets to loggers that support WSJT-X's network protocol
  - Does not generate its own ADIF log (unlike WSJT-X)
  - Supports IPv4 and IPv6 uni and multicast
- Enable via Tools->Options->Reporting



New features since last year

More stuff to try

- Received callsigns can now be broadcast on the network
  - Home-grown JSON based protocol over UDP
  - Also supports IPv4 and IPv6 uni and multicast
  - Allows integration into e.g. Node Red
- Enable via Tools->Options->Reporting

New features since last year

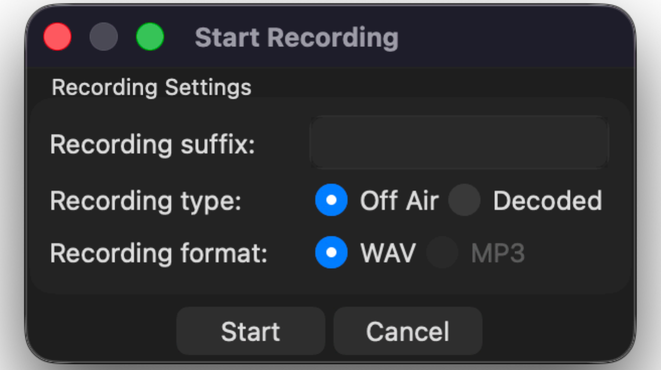
More stuff to try

- “Tune” button added to the main window
  - Emits a carrier to help with tuning antennas/finding freq. offset
  - Defaults to full power level but can be attenuated on a per-band basis
  - Push to start transmitting, push again to stop

New features since last year

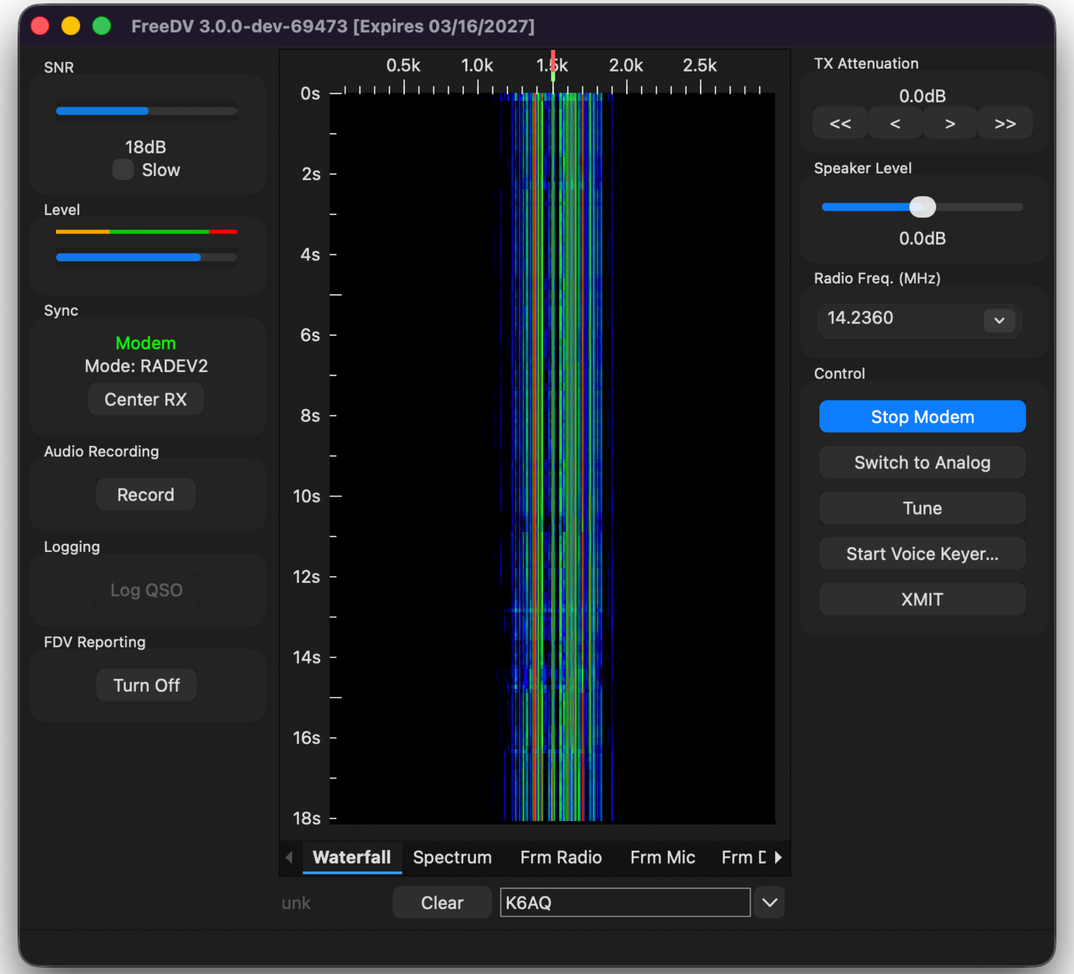
More stuff to try

- Simplified audio recording interface
  - Always saves to configured location with specified suffix
  - Can record either the raw audio from the radio or decoded speech
  - Can record decoded speech in MP3 to save space



One More Thing

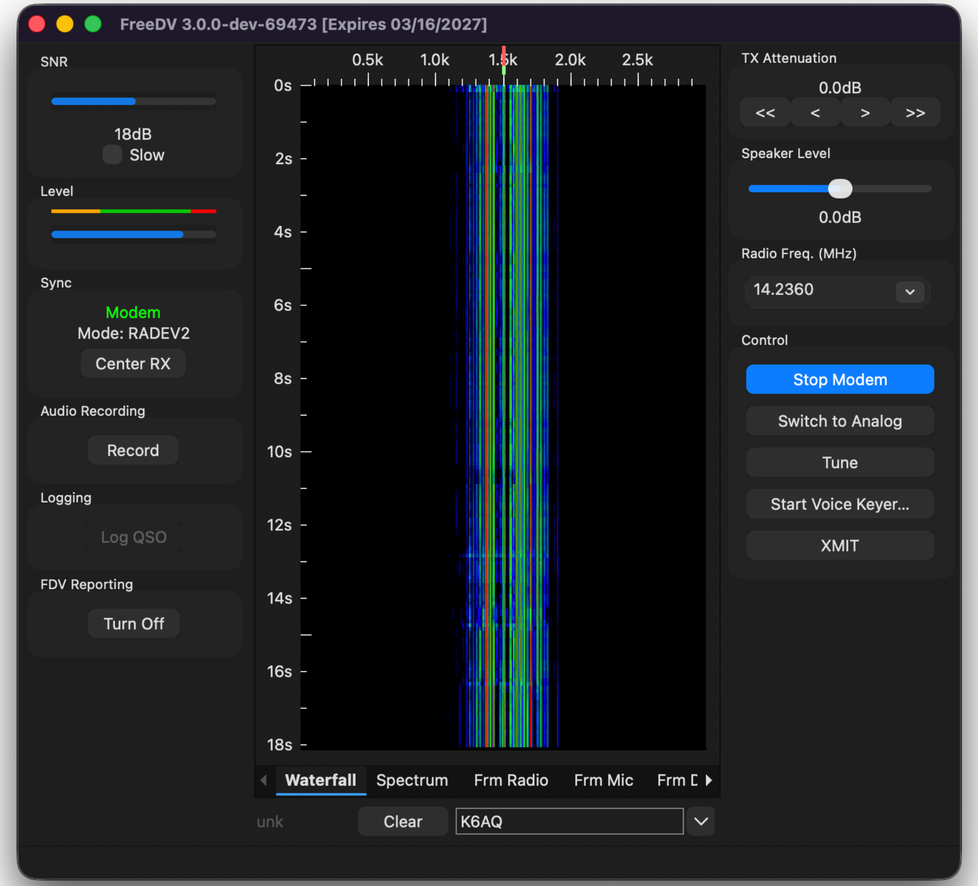
Making FreeDV even better



One More Thing

Making FreeDV even better

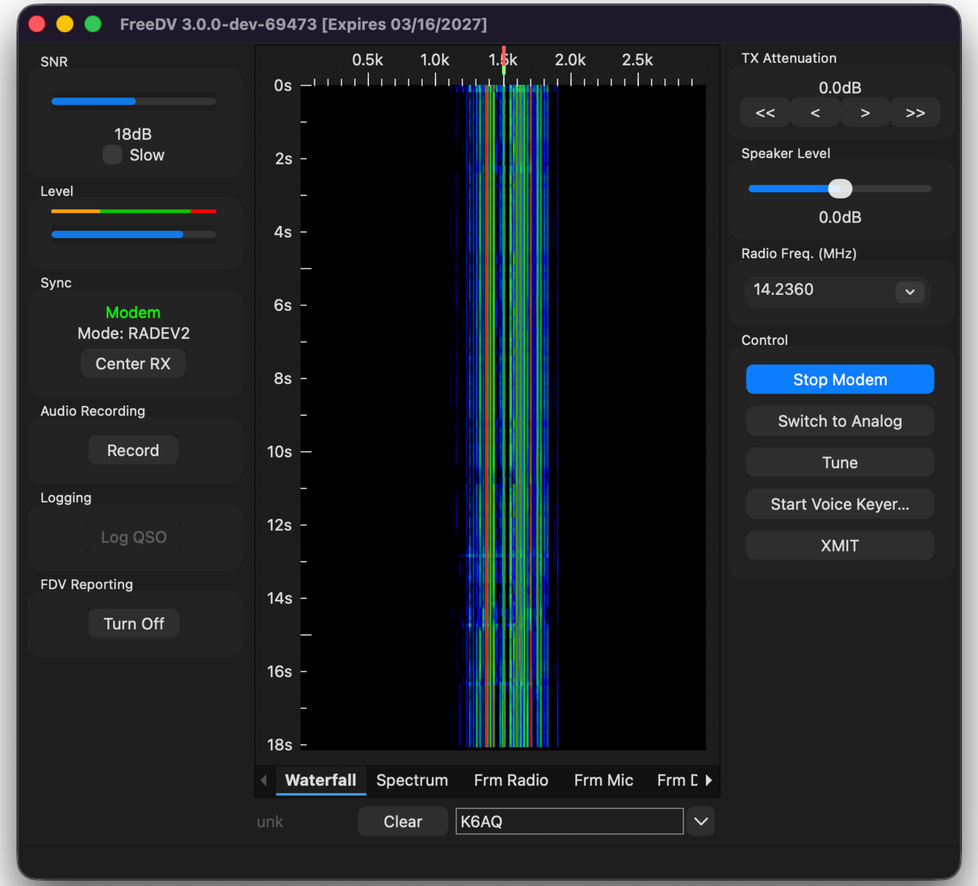
- RADE version 2 (RADEV2)
  - Reduces bandwidth from 1.5 kHz to less than 1 kHz
  - Improved audio quality, especially at higher SNR
  - Lower minimum SNR (-5 dB vs. -2 dB for RADEV1)



One More Thing

Making FreeDV even better

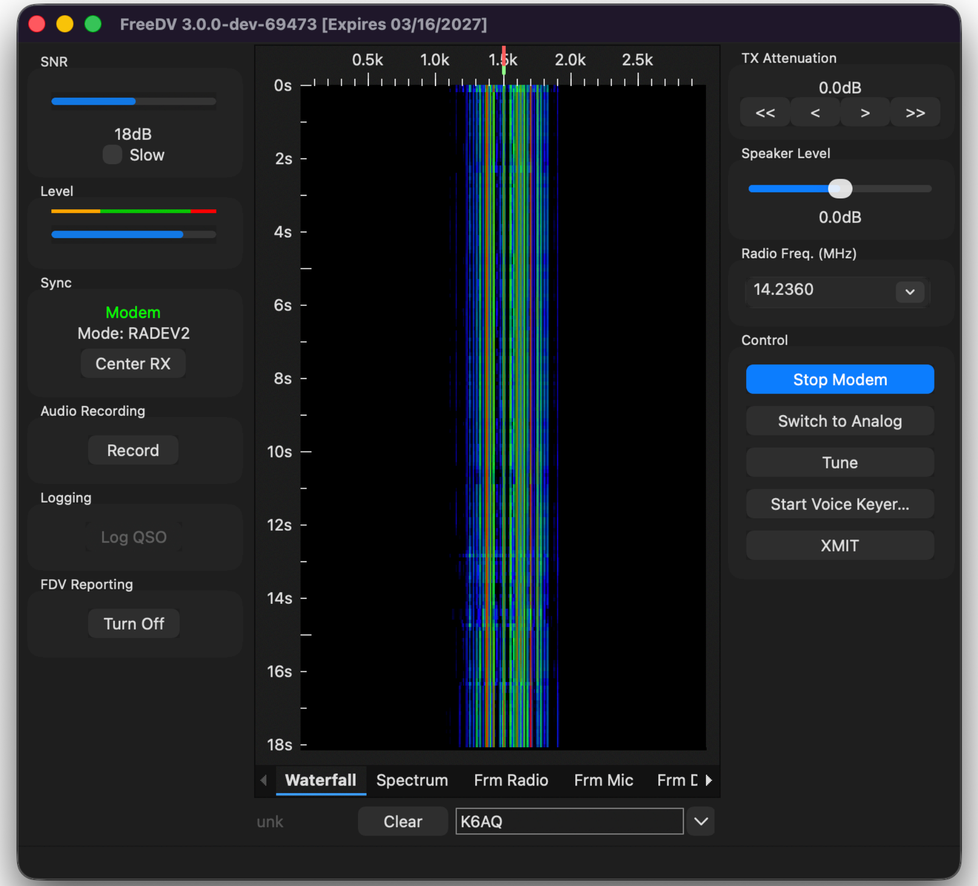
- Improved callsign reporting
  - Callsign is repeatedly transmitted while XMIT is active
  - Compare to RADEV1 (callsign only at end of TX)
  - Backend improvements to allow callsign to decode at lower SNR



One More Thing

Making FreeDV even better

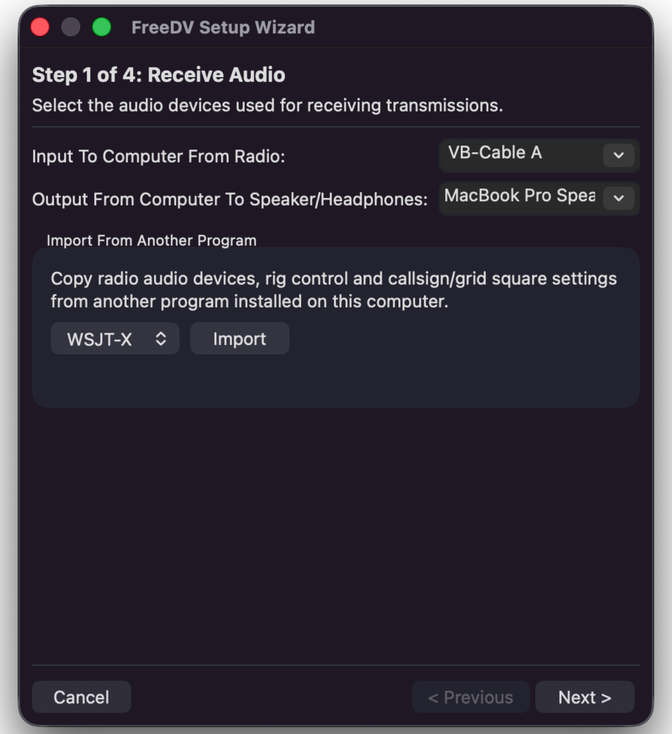
- LSB support has (mostly) been removed
  - Improved ease of use - most digital modes are USB-only
  - Analog button will still put your radio in LSB (and shift frequency)



One More Thing

Making FreeDV even better

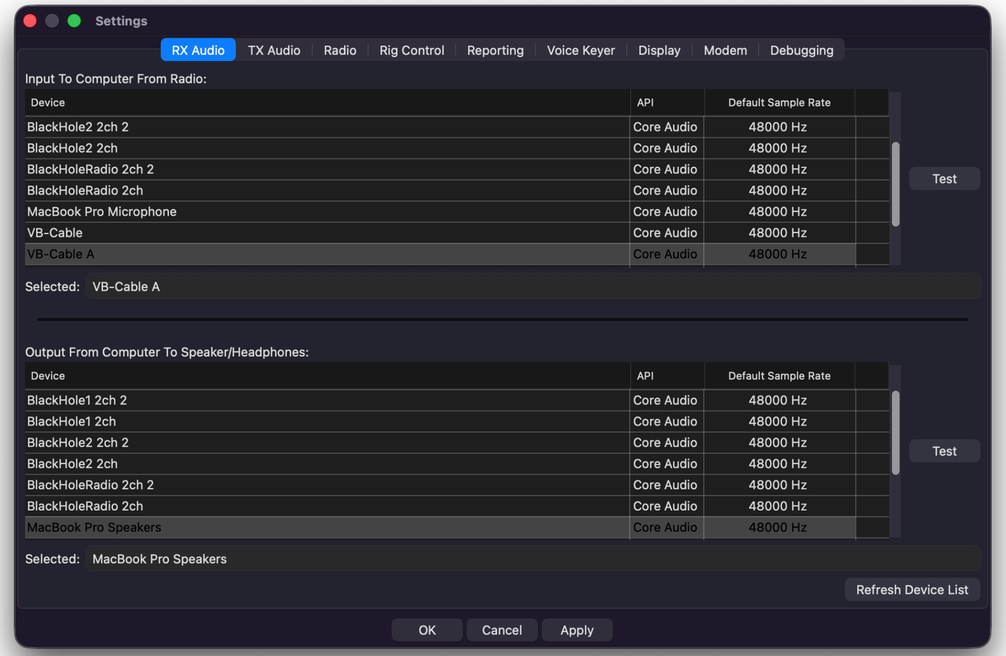
- Improved initial configuration experience
  - “Wizard” style walks you through configuration
  - Can import settings from other ham radio applications
  - Handles more advanced audio setups without jumping through hoops



One More Thing

Making FreeDV even better

- Consolidated configuration into one window
  - No need to go to three different windows anymore
  - No loss in functionality
  - macOS: Now accessible via app menu (same as with other Mac apps)



Thanks for supporting us

Would not be possible without you

- Work on FreeDV has been funded thanks to ARDC and Software Freedom Conservancy
  - https://ardc.net/
  - https://sfconservancy.org/
- Please donate if you support their causes
  - Some donations may be tax deductible (ask your accountant)

Thanks for Listening!

Any questions?

- Contact me anytime with questions: mooneer@gmail.com
- FreeDV Discord (scan QR code or visit freedv.org)