# President's Corner

The 2022 DCC is a wrap. With only a few glitches, our first live conference in three years went very well. While I was not able to attend in person due to last minute family reasons, I did listen to the YouTube feed. The consensus seems to be that everyone who attended was glad to be back in-person at a live event. Even thought attendance was down a bit from past conferences, I will classify this year's DCC a success!

The jury is still out on whether or not next year's DCC will be live or teleconferenced. Drop me a note and let me know your thoughts. One of the possible venues that we are considering is here in Arizona in the Phoenix area. Let me know your opinion on that, too! Remember, we are always looking for local help, so if you would like to see the DCC come to your city, please volunteer to help make it happen.

On the TangerineSDR hardware front, the Magnetometer board build is complete, and documentation is progressing on the kit instructions. We still have a way to go before we are ready to put them up for sale, but we are getting closer. If you are not sure what a Magnetometer is or why you would want one, check out this link: https://tangerinesdr.com/magnetometer.html

Winter is upon us here in the northern hemisphere. Warm up those soldering irons and build a winter project! Then tell us about it in an article and submit it to PSR! Our editor, Stana, is always looking for new and interesting material.

73, Scotty WA2DFI

(Editors Note: Photos from the DCC appear throughout this issue of *PSR*.)

###

**40th Anniversary TAPR 1982-2022**

TAPR is a community that provides leadership and resources to radio amateurs for the purpose of

# Digital Communications Conference 2022 Recap

## By Steve Stroh N8GNJ (Source: Zero Retries)

This is a highly subjective recap from my perspective, not a comprehensive review.

My kudos to the entire team that put on Digital Communications Conference (DCC) 2022. It was one of those rare hybrid in-person and online events that seemed to work equally well for the in-person participants and the online viewers. I really enjoyed watching all three days of DCC 2022, and I learned a lot.

You can catch up on the fun - currently the Youtube livestreams for Friday, Saturday, and Sunday are available. I'm told each of these will be edited into individual presentations, and the Saturday evening banquet talk by Rosy Schechter KJ7RYV, Executive Director of ARDC, is now available. If you'd like to hear a bit about the behind-the-scenes of the video production for DCC 2022, see HamRadioNow's 2022-09-18 episode.

The DCC is a fantastic example of Technological Innovation in Amateur Radio. There is a video record, hopefully TAPR will post the slide decks for the presentations, and there is also the DCC 2022 Proceedings for posterity in both PDF and paperback book. My book arrived this week, and it's an annual treat that I look forward in taking my time reading through the proceedings papers. Not all presentations make it into the Proceedings, and not all papers in the Proceedings (like mine) had a corresponding presentation.

Some highlights after looking over the schedule as a recap…

- I look forward to the next issue of the TAPR *PSR* Newsletter to see what was discussed at the TAPR Board meeting on Thursday preceding the DCC.

- Most of the Friday talks were associated with Amateur Radio Citizen Science Investigation (HamSCI), and they were all good. It is great that the DCC provides opportunities for deep-dive talks and for students to gain valuable experience in publishing papers and doing presentations in front of a technical audience.

- TangerineSDR Prototype Hardware and MagnetoPI Production Status by Scotty Cowling, WA2DFI was a great technical presentation about TAPR's progress on the TangerineSDR (TSDR). At the moment, it's a Software Defined Receiver, but there are plans to implement a transmitter. To me, if you look at the website, it's a bit underwhelming - developing (yet another) Software Defined Radio. But diving deeper, the TSDR is focused on scientific investigation rather than Amateur Radio operating or generic receiving. In this presentation, I learned that there's a fundamental difference with TSDR - they're using a large enough Floating Point Gate Array (FPGA) that TSDR will receive 100 kHz through 54 MHz. OK… lots of Software Defined Receivers can do that. But TSDR receives all of

that 53.9 MHz simultaneously - not tuning to a portion of that range like conventional SD receivers do. That… gets interesting! It was pointed out to me that's not a unique capability, there are other radios that do the same thing, but this one is open source hardware, open source FPGA code, and open source software. At the moment TSDR production is constrained by unavailability of their chosen FPGA, but there's hope that shortage will soon ease. I suspect the approach pioneered by TGSDR will be the basis for most Amateur Radio HF activity by the end of the decade - receive the HF band - all of the HF band, and let the computer sort out what it is you want to receive. The more compute power you can make available, the better the receive capability.

● Claude Shannon's Radiotelegraphy: Progress in Coherent CW by David Kazdan AD8Y was interesting. I had heard of Coherent CW but had not taken the time to understand it. Like I've mentioned here in Zero Retries, AD8Y feels there is potentially a lot of value in revisiting older technologies, projects, etc. that were abandoned or surpassed and take a fresh look at them through the lens of "is this practical now with current technology"?

● Similarly, Amateur Communications Below 9 kHz: The Dreamer's Band and The New EbNaut Digital Mode by Jonathan Rizzo KC3EEY was a subject I'd heard of, but had not taken the time to understand, and now I understand it a bit better.

● During the Lightning Talks, Phil Karn KA9Q did a presentation about an interesting use of his ka9q-radio software - FM Repeater with Multiple Inputs. He explained that AMSAT's use of linear transponders on Amateur Radio satellites have not been able to solve the problem of transmitted power imbalance - if one signal is significantly more powerful than other transmissions in the passband, most of the transponder's transmit power is used for the loudest signal. KA9Q proposes that listening on multiple discrete frequencies simultaneously might solve this power imbalance problem. This is yet another "old problem potentially solved with current technology".

● Tom McDermott N5EG's presentation Starlink AREDN, and Networking was a masterclass in understanding the issues involved in trying to use Internet via Starlink if you wanted to host servers, such as AREDN via Starlink. Starlink uses "Carrier Grade Network Address Translation" (CGNAT) and the problems that creates for anything other than typical Internet access.

● Sunday was devoted to the stories of five recipients of ARDC grants - University of Scranton ARC W3USR, Bridgerland ARC, National Radio Astronomy Observatory, M-17 Project, and

ARISS. All of these were compelling stories about how ARDC grants made a profound difference such as creating clubs and programs from scratch, paying for development equipment, and in the case of ARISS, ensuring stable funding for five years and developing new programs to enhance the ARISS experience in the classroom.

Again, I think that DCC 2022 was a great success and I look forward to DCC 2023 and possibly attending in person. As is always the case, TAPR needs local hosts to help host in-person DCCs. Hopefully next year TAPR can return to their cooperation with GNU Radio Confernce and those two complementary events can be held back to back in the same venue.

If you agree that the DCC is valuable for Amateur Radio, the best way you can support the continuation of the DCC is to simply join TAPR as a member for $30 annually (as I have). One strong recommendation I can offer for TAPR membership is that TAPR, unlike other membership organizations, does not hold its newsletter hostage behind a paywall only for the benefit of paid members. It was a leap of faith for TAPR to publish PSR without a paywall, and I think that is laudable and should be rewarded.

###

# TAPR Elections

No nominations were received for the three Director positions on the TAPR Board of Directors, so the incumbent Directors will serve for another three years. They are:

John Ackermann, N8UR

Dave Larsen, KV0S

Bruce Raymond, ND8I.

Meanwhile, during the DCC in-person Board of Directors meeting, the Board reelected the following slate of officers:

Scotty Cowling, WA2DFI, President

Steve Bible, N7HPR, Vice President

Stana Horzepa, WA1LOU, Secretary

Tom Holmes, N8ZM, Treasurer:

###

*K0PFX photo*

# Internet Archive Seeks Donations of Materials to Build Amateur Radio Digital Library

## By Kay Savetz, K6KJN

Internet Archive has begun gathering content for the Digital Library of Amateur Radio and Communications (DLARC), which will be a massive online library of materials and collections related to amateur radio and early digital communications. The DLARC is funded by a significant grant from the Amateur Radio Digital Communications (ARDC), a private foundation, to create a digital library that documents, preserves, and provides open access to the history of this community.

The library will be a free online resource that combines archived digitized print materials, born-digital content, websites, oral histories, personal collections, and other related records and publications. The goals of the DLARC are to document the history of amateur radio and to provide freely available educational resources for researchers, students, and the general public. This innovative project includes:

- A program to digitize print materials, such as newsletters, journals, books, pamphlets, physical ephemera, and other records from both institutions, groups, and individuals.
- A digital archiving program to archive, curate, and provide access to "born-digital" materials, such as digital photos, websites, videos, and podcasts.
- A personal archiving campaign to ensure the preservation and future access of both print and digital archives of notable individuals and stakeholders in the amateur radio community.
- Conducting oral history interviews with key members of the community.
- Preservation of all physical and print collections donated to the Internet Archive.

The DLARC project is looking for partners and contributors with troves of ham radio, amateur radio, and early digital communications related books, magazines, documents, catalogs, manuals, videos, software, personal archives, and other historical records collections, no matter how big or small. In addition to physical material to digitize, we are looking for podcasts, newsletters, video channels, and other digital content that can enrich the DLARC collections. Internet Archive will work directly with groups, publishers, clubs, individuals, and others to ensure the archiving and perpetual access of contributed collections, their physical preservation, their digitization, and their online availability and promotion for use in research, education, and historical documentation. All collections in this digital library will be universally accessible to any user and there will be a customized access and discovery portal with special features for research and educational uses.

We are extremely grateful to ARDC for funding this project and are very excited to work with this community to explore a multi-format

digital library that documents and ensures access to the history of a specific, noteworthy community. Anyone with material to contribute to the DLARC library, questions about the project, or interest in similar digital library building projects for other professional communities, please contact:

Kay Savetz, K6KJN
Program Manager, Special Collections
kay@archive.org
Twitter: @KaySavetz

###

*K0PFX photo*

*K9TRV photo*

# "Grapeless" Grape: Participating in the HamSCI Grape Software Defined Radio Project (minus the Grape)

## By Michael Hauan, AC0G

When variations in ionospheric conditions change the signal path length between a transmitter and a distant receiver, subtle frequency and amplitude variations occur. HamSCI (https://hamsci.org/ ) has developed an active "crowd-sourced" data-gathering project to help study earth's "space weather" by making high precision measurements of WWV or CHU carrier broadcasts.

Part of this project includes development of an affordable Personal Space Weather Station (PSWS) capable of making such measurements (and more -- see https://www.hamsci.org/basic-project/personal-space-weather-station/ ). You will find an excellent write-up of the first product toward this end, "Grape Version 1," at https://doi.org/10.1016/j.ohx.2002.e00289. The hardware included a simple, customized "Grape" receiver, a GPSDO, and a Raspberry Pi.

At present, HamSCI no longer distributes the Grape V1. More capable versions, "Grape V2" and ultimately "Tangerine," remain in development by HamSCI (in cooperation with TAPR) but with an uncertain schedule of availability.

However, you can still participate in the HamSCI project and contribute potentially valuable data about ionospheric conditions, without a Grape or Tangerine, by building your own.

The general problems remain the same:

1) to measure a WWV or CHU carrier with sufficient frequency accuracy and stability,

2) to record the measurements in a standard format, and

3) to send them to the HamSCI data repository.

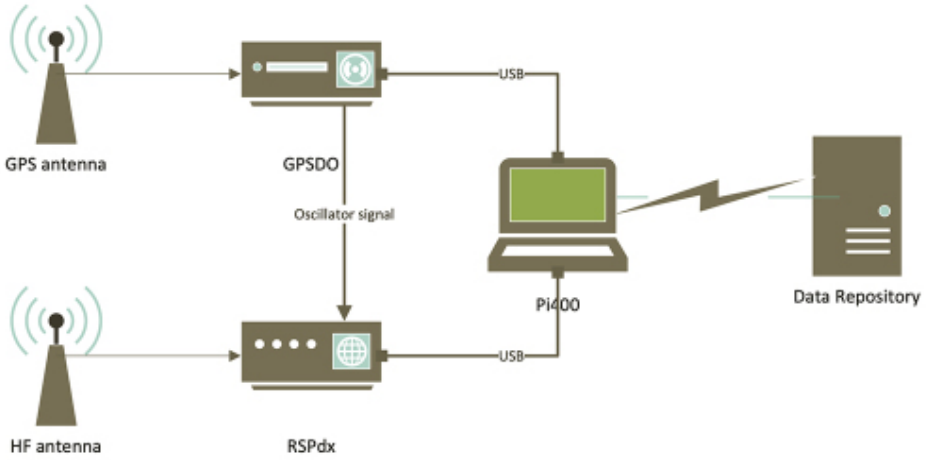
The age-old ham way of solving problems like this typically leverages work someone else has already done, uses gear already in the shack, and when it's absolutely necessary, resorts to purchase of any remaining items.

In what follows, I present one particular solution so that, if you have the same or similar gear, you can quickly build your own PSWS without a Grape. But even if your gear differs, this specific example may suggest more generally how you might contribute to this HamSCI project with a different radio, GPSDO, or computer platform.

For instance, you can readily solve problems 2) and 3) if you already have a Raspberry Pi (RPi) version 3 or 4 and an internet connection. HamSCI makes available an RPi image (based on 32-bit Buster Raspian OS) customized to manage collection,

initial processing, and transmission of frequency measurements to a central data repository. You simply need to configure this according to the instructions included on the RPi image (see details below). If you do not have an RPi, I think a modest amount of work would enable the customized FLDIGI software and data handling python scripts on the RPi image to run on other architectures or platforms (e.g., Linux, Windows, and Mac OS). I have not (yet!) tried this, however.

Solving problem 1) presents a somewhat greater challenge since capturing good quality data requires a frequency-stabilized radio between the signal input from your antenna and your data collection method. Such equipment can really stress the pocketbook. You might already have a high-quality rig capable of precise frequency control but not want to confine it to the single purpose of 24x7 ionospheric monitoring. The Grape kit provided a very simple and affordable receiver that used the precise oscillator from a separate GPSDO. I happened to have a software-defined radio from SDRPlay, the RSPdx, which conveniently can utilize an external oscillator. However, I still needed a GPSDO which I purchased from https://www.leobodnar.com/shop/ (also available at https://sdr-kits.net/). I also have an OpenHPSDR but have not (yet!) built the Excalibur board that enables it to use an external oscillator. Once I accomplish this, I can increase its accuracy with a GPSDO and dedicate one or more receivers to data gathering (the OpenHPSDR supports roughly a half dozen concurrently depending on network speed and computer horsepower). A Hermes or Red Pitaya might well work the same.

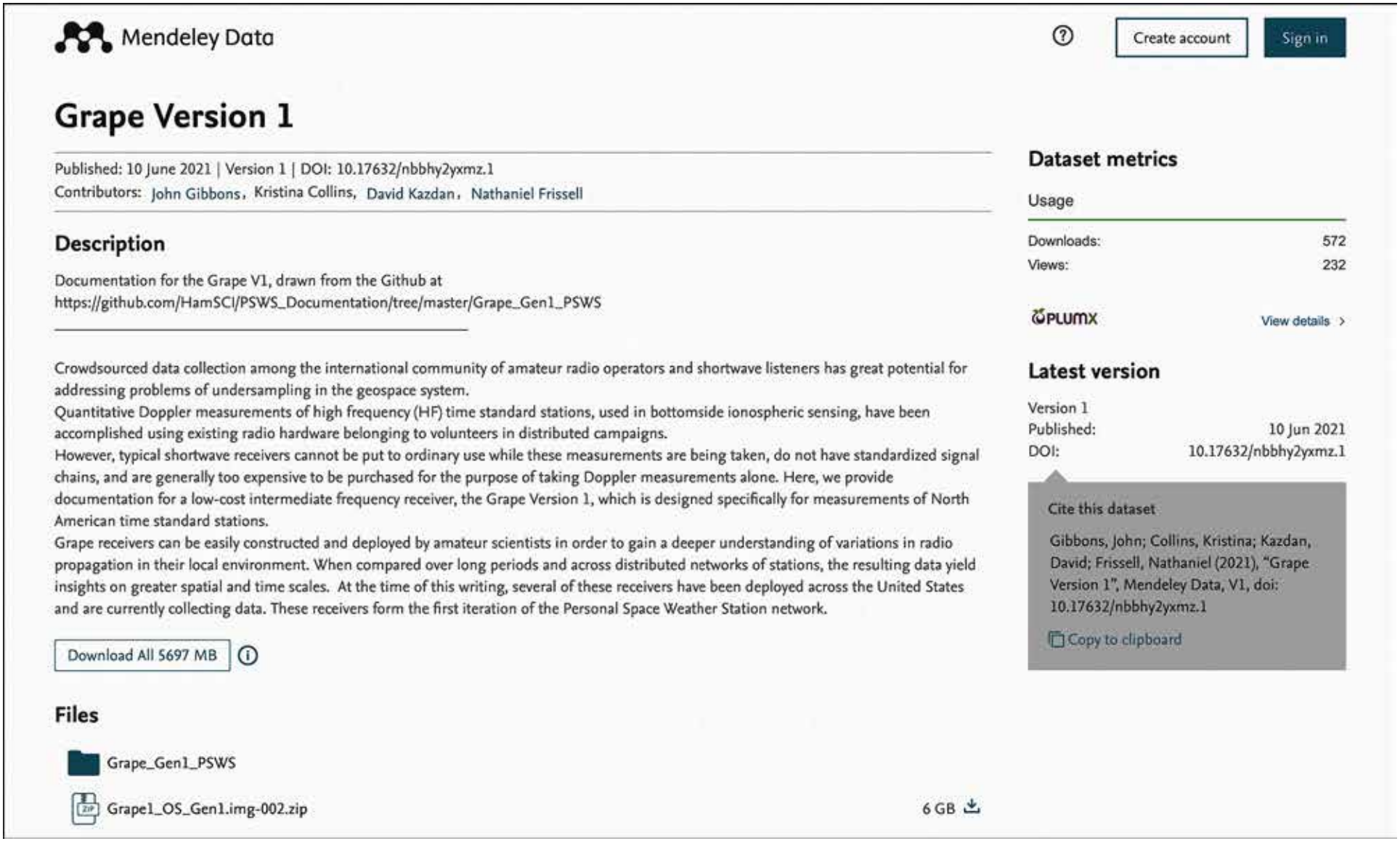



I implemented a working "Grapeless Grape" with the following hardware:

- Antenna: longwire
- Computer: Pi400 with Grape RPi image (prepared by John Gibbons, N8OBJ)
- Radio: RSPdx (RSPduo works, too.)
- Frequency discipline: Leo Bodnar GPSDO

Assembly and configuration steps:

**1) Download the HamSCI Grape RPI image** at https://data.mendeley.com/datasets/nbbhy2yxmz/1 or https://doi.org/10.17632/nbbhy2yxmz.1 and install it on your Rpi.



Mendeley Data

Create account Sign in

# Grape Version 1

Published: 10 June 2021 | Version 1 | DOI: 10.17632/nbbhy2yxmz.1
Contributors: John Gibbons, Kristina Collins, David Kazdan, Nathaniel Frissell

## Description

Documentation for the Grape V1, drawn from the Github at
https://github.com/HamSCI/PSWS_Documentation/tree/master/Grape_Gen1_PSWS

Crowdsourced data collection among the international community of amateur radio operators and shortwave listeners has great potential for addressing problems of undersampling in the geospace system.
Quantitative Doppler measurements of high frequency (HF) time standard stations, used in bottomside ionospheric sensing, have been accomplished using existing radio hardware belonging to volunteers in distributed campaigns.
However, typical shortwave receivers cannot be put to ordinary use while these measurements are being taken, do not have standardized signal chains, and are generally too expensive to be purchased for the purpose of taking Doppler measurements alone. Here, we provide documentation for a low-cost intermediate frequency receiver, the Grape Version 1, which is designed specifically for measurements of North American time standard stations.
Grape receivers can be easily constructed and deployed by amateur scientists in order to gain a deeper understanding of variations in radio propagation in their local environment. When compared over long periods and across distributed networks of stations, the resulting data yield insights on greater spatial and time scales. At the time of this writing, several of these receivers have been deployed across the United States and are currently collecting data. These receivers form the first iteration of the Personal Space Weather Station network.

Download All 5697 MB

## Files

Grape_Gen1_PSWS

Grape1_OS_Gen1.img-002.zip 6 GB

## Dataset metrics

Usage

| | |
|---|---|
| Downloads: | 572 |
| Views: | 232 |

PLUMX View details >

## Latest version

Version 1
Published: 10 Jun 2021
DOI: 10.17632/nbbhy2yxmz.1

Cite this dataset

Gibbons, John; Collins, Kristina; Kazdan, David; Frissell, Nathaniel (2021), "Grape Version 1", Mendeley Data, V1, doi: 10.17632/nbbhy2yxmz.1

Copy to clipboard

**2) Configure your station information.**

Follow Mr. Gibbons' instructions for configuring his RPi image and to register your setup with HamSCI as a recognized Grape node.

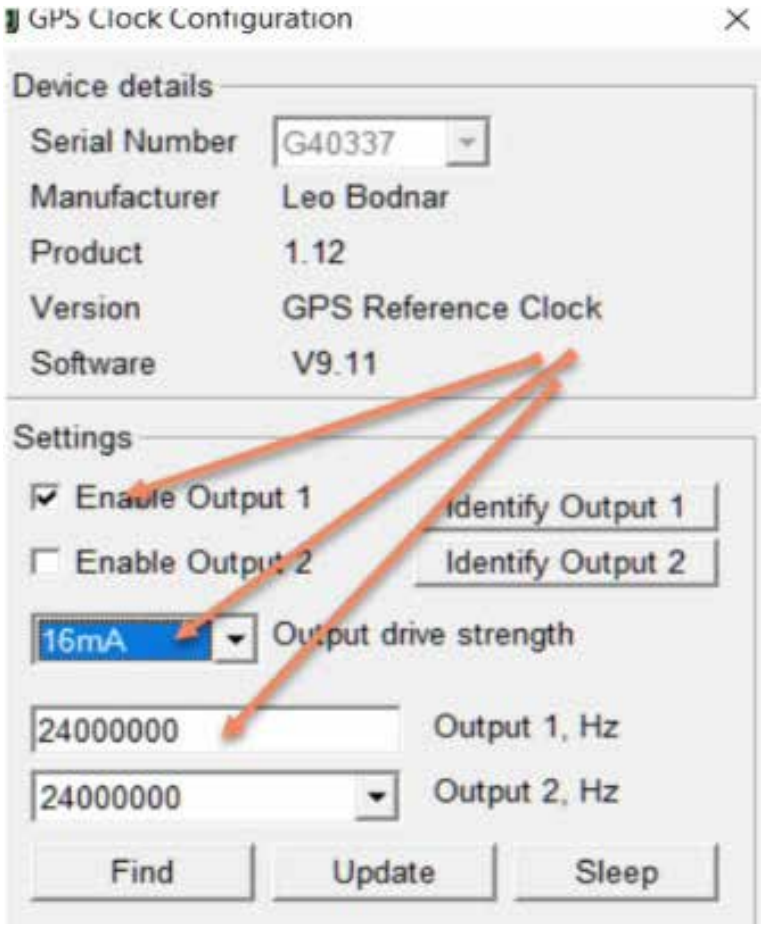
**3) Configure the GPSDO.**

The HamSCI RPi image has compiled binaries and source code in /home/pi/lbgpsdo. The RSPdx requires 16mA drive and 24MHz oscillation. You can also download configuration software from https://www.leobodnar.com/. However, you will only find compiled binaries for Windows and Mac. Once configured on any computer, though, it will power on in that configuration until you reconfigure it. You can provide the GPSDO with USB power from the RPi or any other 5VDC source.

**4) Connect your radio, GPSDO, and RPi.**

Connect your RSPdx to your antenna, GPSDO, and RPi via USB.

Connect your GPSDO to a GPS antenna and to your RPi via USB.



**5) Get the radio control software.**

Using your RPi, navigate to https://www.sdrplay.com/downloads/. Specify the radio (RSPdx) and platform (ARM Raspberry Pi OS). The site will then provide individual links to the appropriate API and CubicSDR to download. Note that SDRPlay, on the same page, also provides "Build Scripts 0.3" that will download and build everything you need, greatly simplifying the process.

**6) Start FLDIGI** (will probably have started on boot), CubicSDR, and PulseAudio Volume Control

(RPi Menu-->Sound&Video)

**7) Configure PulseAudio to pipe audio output from CubicSDR to FLDIGI**.

Edit (or create) /home/pi/.config/pulse/default.pa to include the following:

.include /etc/pulse/default.pa

### RSPdx

load-module module-null-sink sink_name=RSPdx sink_properties="device.description='RSPdx'"

This creates a pipe (aka, virtual audio cable) called "RSPdx."

Restart pulseaudio with:

pi@pi400:/home/pi$ pulseaudio -k

Or simply reboot your RPi.

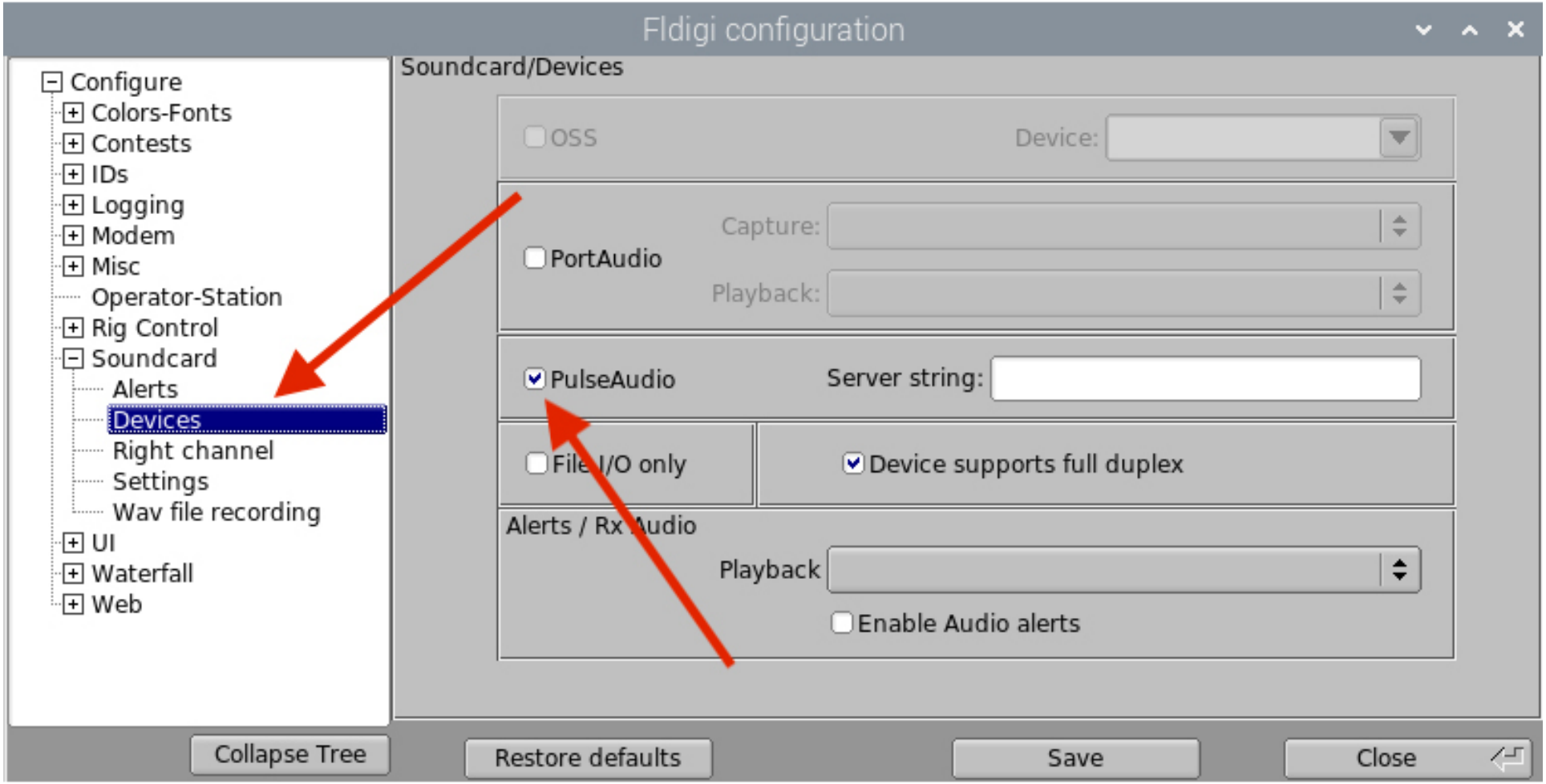
In the "Playback" tab, set the ALSA plug-in [CubicSDR] to playback on "RSPdx."

In the "Recording" tab, set the capture item with the FLDIGI icon to "Monitor of RSPdx."

This sends CubicSDR output to FLDIGI input via the pipe.

**8) Configure FLDIGI.**

In FLDIGI, select Configure-->Soundcard-->Devices and click the PulseAudio checkbox.Configure FLDIGI monitoring.


Fldigi configuration
Configure
Colors-Fonts
Contests
IDs
Logging
Modem
Misc
Operator-Station
Rig Control
Soundcard
Alerts
Devices
Right channel
Settings
Wav file recording
UI
Waterfall
Web
Soundcard/Devices
OSS
Device:
PortAudio
Capture:
Playback:
PulseAudio
Server string:
File I/O only
Device supports full duplex
Alerts / Rx Audio
Playback
Enable Audio alerts
Collapse Tree
Restore defaults
Save
Close

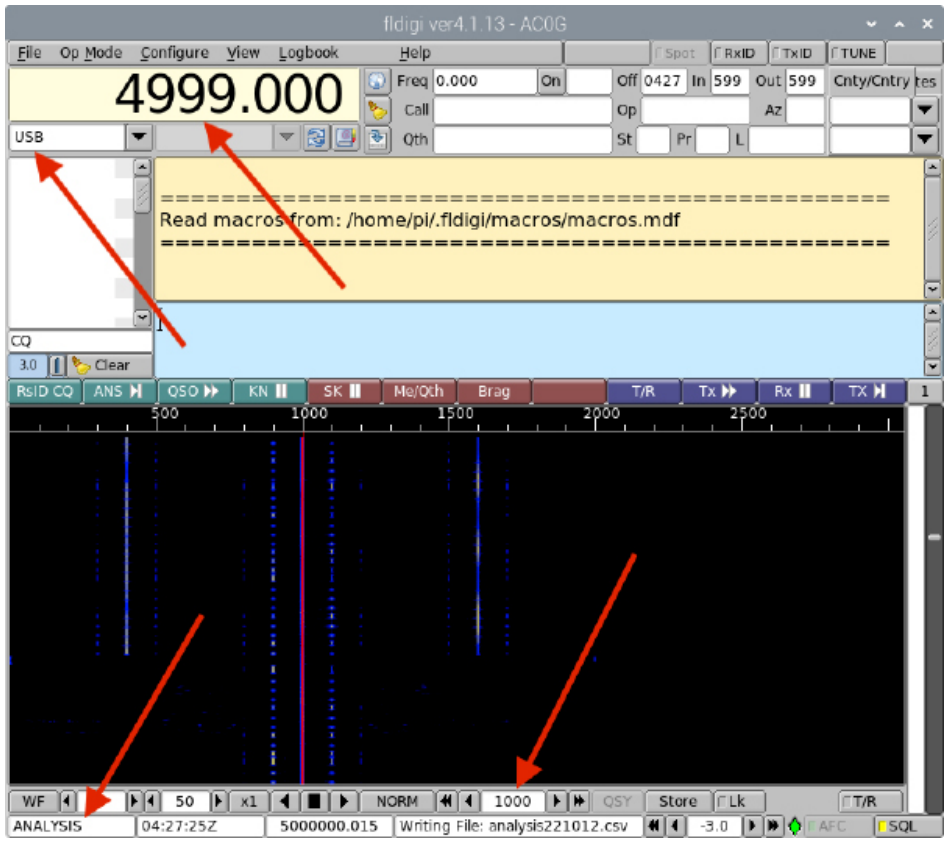
Set the RF frequency settings (per Mr. Gibbons' instructions) 1 KHz below whichever WWV station you plan to monitor, e.g., 4999.00 KHz.

Set the Op Mode to Frequency Analysis (which records its measurements in a .csv file as below

| UTC | Freq | Freq Err | Vpk | dBV(Vpk) |
|---|---|---|---|---|
| 2022-10-09T00:00:00Z | 4999999.69 | -0.31 | 0.327979 | -9.68 |
| 2022-10-09T00:00:01Z | 4999999.72 | -0.28 | 0.304283 | -10.33 |
| 2022-10-09T00:00:02Z | 4999999.68 | -0.32 | 0.252832 | -11.94 |
| 2022-10-09T00:00:03Z | 4999999.641 | -0.359 | 0.242374 | -12.31 |
| 2022-10-09T00:00:04Z | 4999999.624 | -0.376 | 0.284046 | -10.93 |
| 2022-10-09T00:00:05Z | 4999999.666 | -0.334 | 0.356359 | -8.96 |
| 2022-10-09T00:00:06Z | 4999999.662 | -0.338 | 0.357328 | -8.94 |
| 2022-10-09T00:00:07Z | 4999999.666 | -0.334 | 0.372256 | -8.58 |
| 2022-10-09T00:00:08Z | 4999999.69 | -0.31 | 0.368372 | -8.67 |
| 2022-10-09T00:00:09Z | 4999999.681 | -0.319 | 0.321973 | -9.84 |

Set the audio frequency to 1000 Hz. The will place a red analysis line over the carrier frequency at 1000 Hz above 4999.000 KHz as below.

In Configure-->Soundcard-->Settings, adjust the Rx ppm to read as close to the WWV carrier (e.g. 5000000.000 Hz) as possible. Do this during daytime hours when the frequency




varies least (note the stable line between 1500Z and 1800Z in the graph of one day's WWV monitoring below).

Also in Configure-->Soundcard-->Settings, select the "Best Sinc interpreter" for Converter if your CPU can stand it.

**9) Configure CubicSDR.**

In File-->Devices, select your SDR device. (I used RSPdx.)

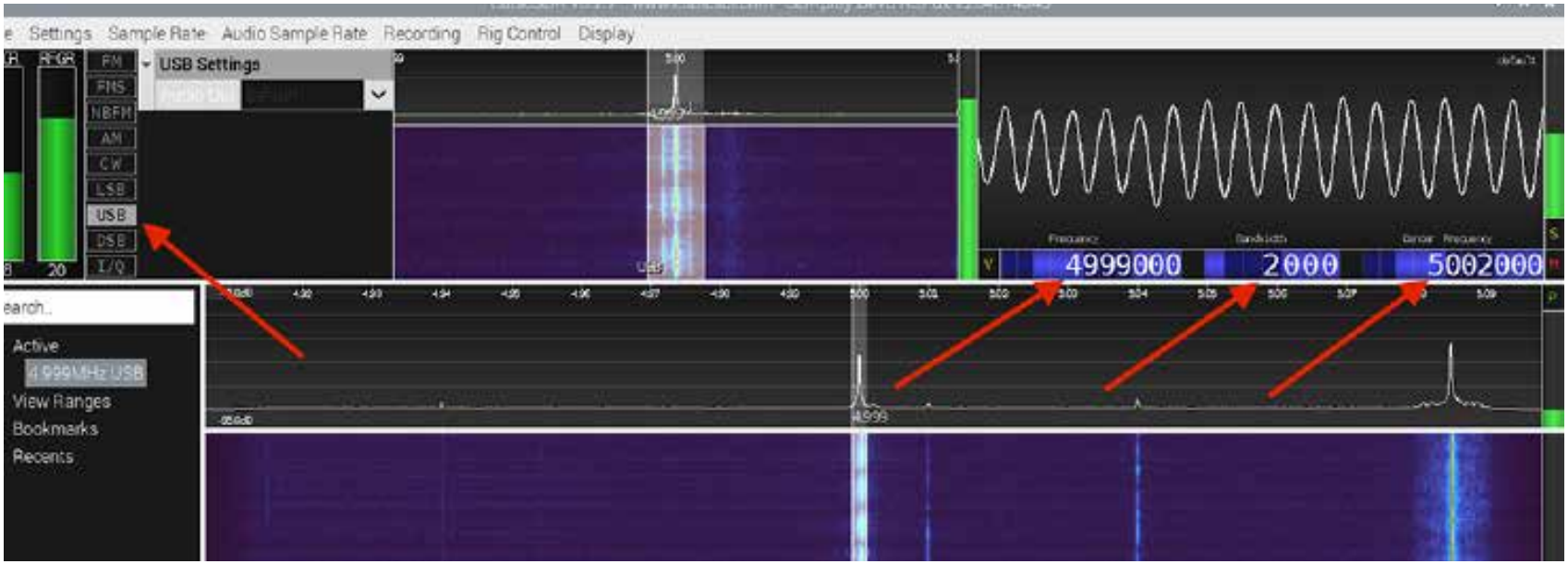
On the main screen:

Set the frequency to 4.999 MHz (or comparably for other WWV or CHU stations).

Set the bandwidth to something over 1200 KHz.

Set the Center frequency a few KHz from the monitored frequency. (I used 5.002 MHz.)

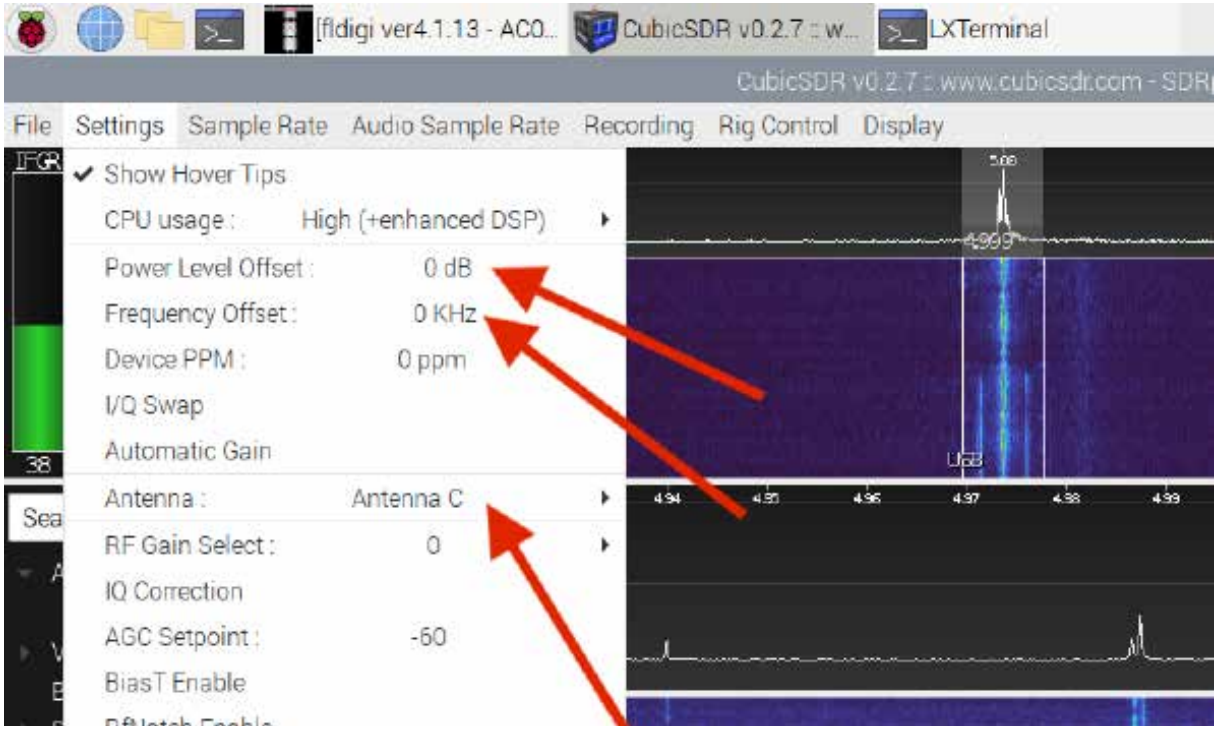
Set the mode to USB.



In Settings-->Antenna, select the correct antenna port. (I used Antenna C -- the RSPdx has A, B, and C ports.)

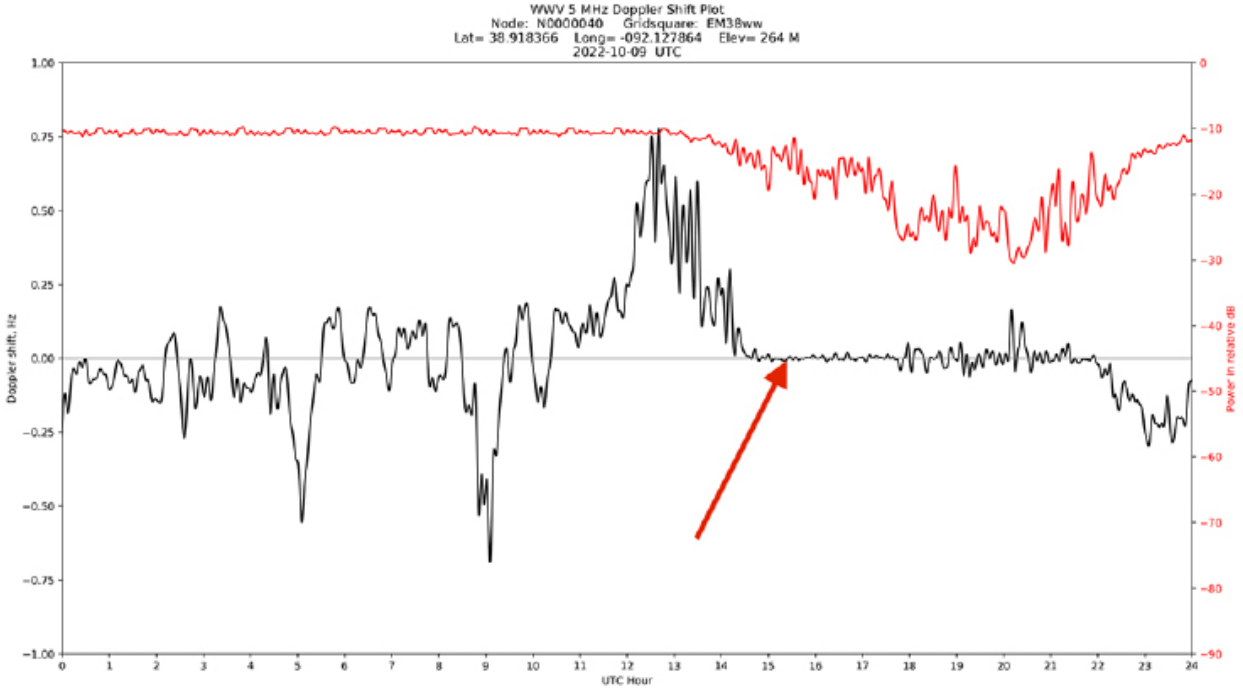
In Settings--> set both Frequency Offset and Power Offset to 0.

In File-->Session select "Save Session As" and provide a name for storing a session configuration .xml file to Open (in File-->Session again) on subsequent starts of CubicSDR.




Having successfully completed the above steps, I suggest you reboot the RPi. FLDIGI and PulseAudio will start automatically but you will have to start CubicSDR and open the saved session configuration file.

With CubicSDR passing its audio output properly to FLDIGI you will see a typical waterfall with the WWV carrier under a red line, FLDIGI will be saving its frequency analysis measurements, and Mr. Gibbon's python scripts will automatically process the FLDIGI data once a day and send it to the HamSCI repository.




## Conclusion

The HamSCI mission to study space weather (and other subjects) explicitly seeks to leverage the equipment, experience, and geographic dispersal of interested hams and citizen scientists. HamSCI contributes several resources to support this including ongoing efforts to develop affordable, scientific-grade data-gathering kits, software configurations, data repositories, special events, and more. The Grape Version 1 demonstrated the capacity of a simple and affordable kit to collect usable data. Even without the Grape receiver (or its planned successors), its software configurations and data repository remain available. As the "grapeless" Grape project described here shows, we can build on its example and resources to contribute to the science of space weather.

####

# Thank-you

TAPR thanks the following entities for their contributions of prizes for the 2022 Digital Communications Conference:

ARRL
Bob Strickland
DX Engineering
Ham Radio Deluxe
Heil Sound
HRO
MFJ
Samlex America
Tigertronics
West Mountain Radio.

###

# TAPR Bits

## By Stana Horzepa, WA1LOU

• Due to various market factors, the price of some TAPR products will likely go up next year, so it behooves you to buy now if you were planning to purchase any TAPR products.

• To purchase printed copies of the 2022 Digital Communications Conference (DCC) proceedings, click here.

• Laura and former TAPR Director John Koster, W9DDD, are sipping some TAPR Kool-Aid during their retirement. Meanwhile, your *PSR* editor found the TAPR logo in Aldi's Aisle of Shame.

###

# GPS Jamming - Correspondence with Time Nut N8UR

## By Steve Stroh N8GNJ (Source: Zero Retries)

Amateur Radio is using GPS a lot more than it used to, primarily for high-resolution time synchronization for experimentation on HF, such as Weak Signal Propagation Reporter (WSPR), and more recently, the plan to use it for experiments on HF by Ham Radio Science Citizen Investigation (HamSCI).

Thus, one of the presentations I enjoyed from DCC 2022 a few weeks ago was by John Ackermann N8UR - Using a GPS as an RF Source: Possibilities and Pitfalls. As background, N8UR cheerfully confesses to being a "Time Nut", Amateurs (not necessarily Amateur Radio Operators) who are interested in measurement of precise time and frequency.

https://www.youtube.com/watch?v=5jHQeJHhk4A&t=22919s

I wrote to N8UR:

While it's not an issue for something like the Tangerine SDR used for research and experimentation for Amateur Radio (and academia), I'm starting to get nervous about assuming GPS is always going to be available for "critical" systems like digital voice repeaters.

This article is just the latest to sound the alarm - GPS Jammers Are Being Used to Hijack Trucks and Down Drones.

Is it possible to build systems that use GPS when it's available, but don't degrade catastrophically when GPS is jammed? And is it possible to know GPS is being jammed (like if a fixed device moves significantly, can you assume that GPS is being tampered with)?

N8UR replied (reprinted with permission):

In short, the u-blox receivers have some capability of detecting and reporting interference. I've never played with it so not sure just what it can do. I don't know what that does for immunity, but at least it provides some indication there's a problem.

While most timing systems still use GPS only, GLONASS can doing a thoroughly good job, as long as you trust the Russians. You can take it from there... Galileo and Beidou can provide timing, though the experience with them is much less. The UTC realization across all the systems is close enough that you're not going to see a timing difference between them.

Apart from multiple constellations providing some backup capability, the new frequencies should help. The L2C signal is supposed to be more robust and provides a backup to L1C/A. L1C has better SNR capabilities, and L5 is in a different frequency band and has a significantly higher power. So the three of those should improve the robustness and make it harder to completely jam reception.

If all else fails, most GPSDO have some sort of holdover capability to keep the oscillator relatively stable during outages. The best of them learn the XO aging rate, and sometimes have temp sensors, so they can intelligently adjust the frequency during an outage. They need that to meet the telco standard of some uS time offset in 24 hours.

The chip we're using in TangerineSDR isn't that sophisticated, but it retains up to (IIRC) 60 seconds of prior history to inform short term

steering if there's an outage. That's probably mainly useful to avoid abrupt phase jumps when the system goes in and out of lock.

Despite all that, count me in the camp that thinks we need to bring up eLoran as a backup system. I've heard talk of Starlink as a navigation aid, but I have no idea how that would work and whether it would yield timing information. I'd think the high doppler from those low orbits would be a problem.

I'm slightly less nervous about GPS now.

###


*N8ZM photo*

*K9TRV photo*

*N8ZM photo*

# Write Here!

Your *PSR* editor is working on the next issue of *PSR* and hopes to find a few good writers, particularly ham radio operators working on the digital side of our hobby, who would like to write about their activities and have them published here in *PSR*.

You don't have to be Hiram Percy Maxim to contribute to *PSR* and you don't have to use *Microsoft Word* to compose your thoughts.

Your *PSR* editor can handle just about any text and graphic format, so don't be afraid to submit whatever you have to wa1lou@tapr.org --- she can handle it!

The deadline for the next issue of *PSR* is February 1, so write early and write often.

###

# On the Net

## By Mark Thompson, WB9QZB

### Facebook

As you may know, TAPR has a Facebook page, www.facebook.com/TAPRDigitalHam.

However, I also created a TAPR Facebook Group, www.facebook.com/groups/TAPRDigital/.

If you have a Facebook account, "Like" the TAPR Facebook page and join the TAPR Facebook Group.

If you join the group click on the Events link and indicate you're Going to the events.

### On Twitter, Too

Access the TAPR Twitter account at www.twitter.com/taprdigital.

### Also on YouTube

TAPR now has its own channel on YouTube: the TAPR Digital Videos Channel: www.youtube.com/user/TAPRDigitalVideo.

At this time, there are a slew of videos on our channel including many from the TAPR-ARRL Digital Communications Conference (DCC) that you may view at no cost, so have at it!

###

## PSR

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## Submission Guidelines

TAPR is always interested in receiving information and articles for publication. If you have an idea for an article you would like to see, or you or someone you know is doing something that would interest TAPR, please contact the editor (wa1lou@tapr.org) so that your work can be shared with the Amateur Radio community. If you feel uncomfortable or otherwise unable to write an article yourself, please contact the editor for assistance. Preferred format for articles is plain ASCII text (OpenOffice or *Microsoft Word* is acceptable). Preferred graphic formats are PS/EPS/TIFF (diagrams, black and white photographs), or TIFF/JPEG/GIF (color photographs). Please submit graphics at a minimum of 300 DPI.

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