

WSPR

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April 2019

Update to RTL-SDR section January, 2020 and February 15, 2021

Note: WSPR is explained in many Internet sites and there is an excellent WSPR User Guide in the WSJT-X documentation.

1. INTRODUCTION TO WSPR

(pronounced Whisper)

- WSPR stands for Wweak-Signal-Propagation-Reporter.
- WSPR is a digital Amateur Radio mode to measure radio propagation of ham radio signals.
- WSPR is one of Joe Taylor's WSJT-X open source suit of modes that include:

FT8, JT4, JT9, JT65, QRA64, ISCAT, WSPR, Echo

These modes enable digital radio communications having low signal to noise characteristics (low transmission power and long distances) by using a combination of specialized encoding and error correction.

1. INTRODUCTION TO WSPR - Continued

- *WSPR transmission uses ... "a compressed data format with strong forward error correction (FEC) and narrow band, four-tone frequency-shift-keying ... The FEC greatly improves chances of copy and reduces errors to an extremely low rate." Taylor and Walker, "WSPRIN Around the world", QST November 2010, pp:30-32*
- Microcomputer versions of WSJT-X PC, MacIntosh, and Linux can be downloaded from <http://www.physics.princeton.edu/pulsar/K1JT/>
- WSPR is available on nearly all ham bands

2: THERE ARE THREE PRIMARY ENTITIES INVOLVED WITH WSPR

- i) WSPR signal transmitters, hams worldwide who want to see where their signals can be heard to judge the capabilities of their rigs and assess propagation conditions.
- ii) WSPR signal monitors, hams and radio listeners (e.g. shortwave listeners) worldwide who receive signals and report them in real time over the Internet to the central repository.
- iii) WSPRnet is the Internet real time collector and displayer of monitored WSPR transmissions. The URL is WSPRnet.org.

3. COMPARISON OF MAJOR INTERNET - BASED AMATEUR RADIO SIGNAL REPORTERS. WHERE DOES WSPR FIT IN?

	REVERSE BEACON NETWORK	PSK REPORTER	WSPR
Primary Purpose	Spot Current DX Targets and Advertise Your Availability (e.g. contests, awards), Collect and Analyze Data on Station Global Reception. Useful for Station Transmission Testing.	Spot Current DX Targets and Advertise Your Availability (e.g. contests, awards), Collect and Analyze DX Reception and Transmission Potential; Useful for Station Transmission Testing	Identify Propagation Paths with Low-power Transmissions Ideal for Testing Antenna Receiving and Sending <u>DOES NOT SPOT CONTACTS</u>

	REVERSE BEACON NETWORK	PSK REPORTER	WSPR
Modes	Reception of “CQ or TEST”: With CW, RTTY, PSKXX picked up by skimmer stations, also as many as 18 Beacons Stations Worldwide (coordinated on 5 HF bands by the International Amateur Radio Union - Canada's beacon is at Eureka, Nunavut)	Reception of “CQ” or a Station Making Contact with A Monitor in Many Modes. Recently Including: FT8, CW, JS8, PSKxxx, JT65, MSK144, SIM31, ROS, RTTY, OPERA, JT9, OLIVIA-x, PI4, MFSK, HELL	Beacon Using Prescribed Format
Frequency Selection	Normal Band Plan Usage	Normal Band Plan Usage	Very Specific Frequencies in Each Band
Transmitter Power	Usual for the Mode	Usual for the Mode	A few mW to 5 W (Higher possible but not common)

	REVERSE BEACON NETWORK	PSK REPORTER	WSPR
Monitoring Software	CW, RTTY, PSKXX Skimmers, and Unique PC Run Aggregator Program to Report to the Internet	Reporting Capability Built Into as Many as 34 Amateur Radio CW and Digital Programs, Such as: CW reporter, CW Skimmer, Digital Master 780, fldigi, JS8Call, JT65-HF, JTDX, MSHV, Multipsk, Opera, PI-RX, Red Pitaya FT, Reporter for MixW 40, ROS, SIM, UR5EQF log, WSJT-X (excluding WSPR?)	Part of WSJT-X Suite: Open Source WSPR program for PC, Mac, and Linux; also built into WSPR transmitting devices

	REVERSE BEACON NETWORK	PSK REPORTER	WSPR
Information Provided (Depending on Where Displayed)	Call Signs (continent and country) of transmitters and skimmers, Time-Date of Reception, Frequency / Band, S/N Ratio, Mode, CW, PSKXX, or RTTY, Mode Speed	Call Signs and Maidenhead Locators of Monitor (and Sender - maybe country), Time-Date of Occurrence, Frequency, Received S/N, Monitor Program, Monitor - Antenna, there may be more	Call Signs and Maidenhead Locators of Sender and Monitor, Distance, Direction, Time-Date of the ‘Spot’ , as well as Frequency, Transmitted Power, Received S/N
On-Line Display Options	Map, Current and Historical Tables of spots	Map, Current and Historical Tables of spots	Map, Current and Historical Tables of spots

	REVERSE BEACON NETWORK	PSK REPORTER	WSPR
Active Monitoring Stations	As Many as ~180 Active “skimmer” Stations	As Many as ~4,500 per Hour	Approx. 1,300
Number of Reports	Nov. 24-25, 2018 (contest weekend) - Total ~8,400,000 - Unique Call Signs ~36,000	Daily Feb. 2018 (weekday, includes repeats) - Receptions ~840,000 - Unique Transmitters ~7,400	Daily Feb. 2018 (weekday, includes repeats) - Receptions ~1,400,000 - Peak per Hr. ~54,000 - Unique Callsigns (Transmitters) Heard per Day ~1,600
Four Most Reported Modes	- CW almost all - A Few PSKXX - Even fewer RTTY	Two Hr. Sample: FT8 ~99.3% CW ~0.3% JS8 ~0.2 PSK63 ~0.1%	WSPR 100%

4. OVERVIEW OF THE WSPR SIGNAL

Normal Packet Content

- * Transmission Information – Data Encoding 50 bits
 - . up to 6 digit call sign; no prefix nor suffix (28 bits)
 - . first 4 digits of maidenhead geolocator (15 bits)
 - . power output in dB, reference 1 mW (7 bits)
- * FEC Encoding 112 bits

OVERVIEW OF THE WSPR SIGNAL - Continued

With some implementations there is provision for longer call sign and maidenhead in an extended format, but this requires sending two packets.

- Recommended Type 1 is NORMAL and 1 packet is sent
- Types 2 and 3 have longer than 6 Characters for either callsign or Maidenhead, or both, and require two packets

There is a WSPR-15 variant which transmits in 15 minute intervals (not two minutes) that is intended for very low frequencies such as 136 kHz

OVERVIEW OF THE WSPR SIGNAL - Continued

Signal Parameters

- . SSB, four tone FSK
- . Occupied bandwidth is about **6 Hz** within a 200 Hz dedicated WSPR segment in each band (there are slots for many WSPR signals within the 200 Hz segment; a receiver can decode more than one WSPR signal at a time)
- . Baud Rate is 1.4648 transitions per second
- . Duration of transmission is 110.6 seconds

OVERVIEW OF THE WSPR SIGNAL - Continued

- . Transmissions start at an even minute
- . Minimum S/N for reception is -31 dB on the WSJT scale (2500 Hz reference bandwidth).

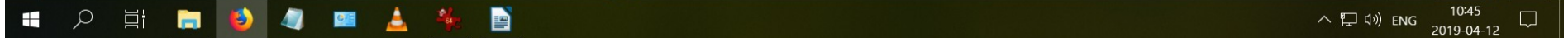
WSPR Etiquette:

- transmission on a band is suggested to occur no more than ~20% of even minute opportunities, e.g. once every ten minutes. This is often relaxed, especially for very weak signals, and there appears to be no consequences.

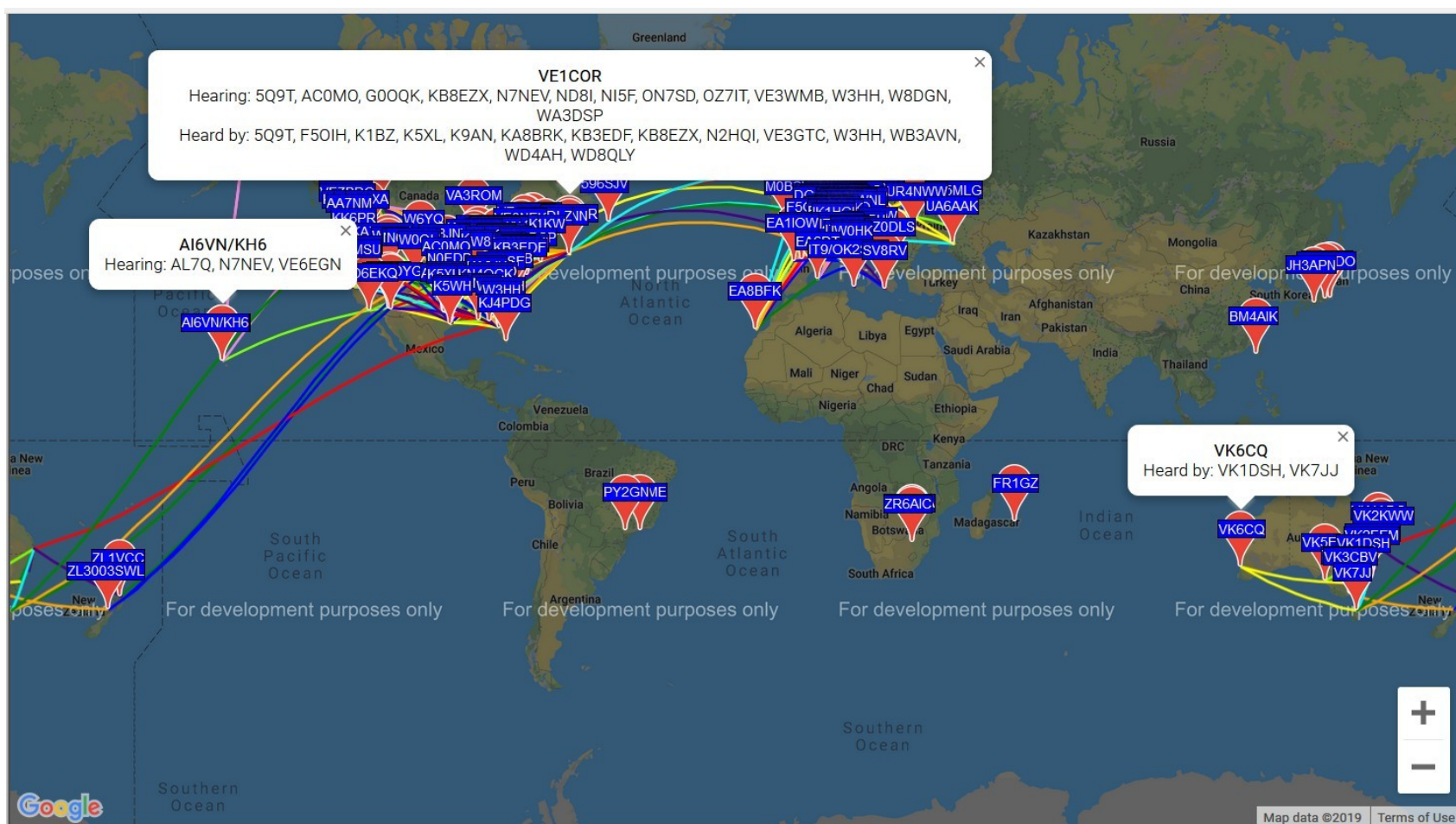
System Requirements:

- accurate knowledge of the time either continually via the Internet or in conjunction with a very stable system clock once started on-time
- very stable receiver/transmitter frequency

Sign-in Default (all callsigns, previous 10 minutes, 30 metres, 1,000 spots)



Highlighting Individual Callsigns on the Map (all callsigns, previous 10 minutes, 30 metres, 1,000 spots. VE1COR Receiving, and Transmitting 1 Watt)



Using the WSPRnet.org Map - Continued

Filters - under the map

Map | WSPRnet - Mozilla Firefox

Map | WSPRnet

wsprnet.org/drupal/wsprnet/map

Firefox prevented this page from automatically reloading.

Navigation

- Forums

3rd Party Maps and Data

- M0XDK Map
- KB9AMG Monthly Stats

Who's online

There are currently 82 users online.

- G3ZIL
- N3SZ
- vk2kcm
- G8CQX
- VK3MI
- G4XWR
- w2gnn
- G4Zfq
- VE3KCL
- HS0ZKM
- JH1OFX
- G0NCE

Update

Band

30m

Show only spots on this band.

☐ Use Band Colors

When checked on, path colors are coded according to band

Call

If non-blank, show only those spots involving the specified call

Latitude

20

Center of map latitude

Longitude

20

Center of map longitude (east positive, west negative)

Time period

10 minutes

Show spots in this period of time

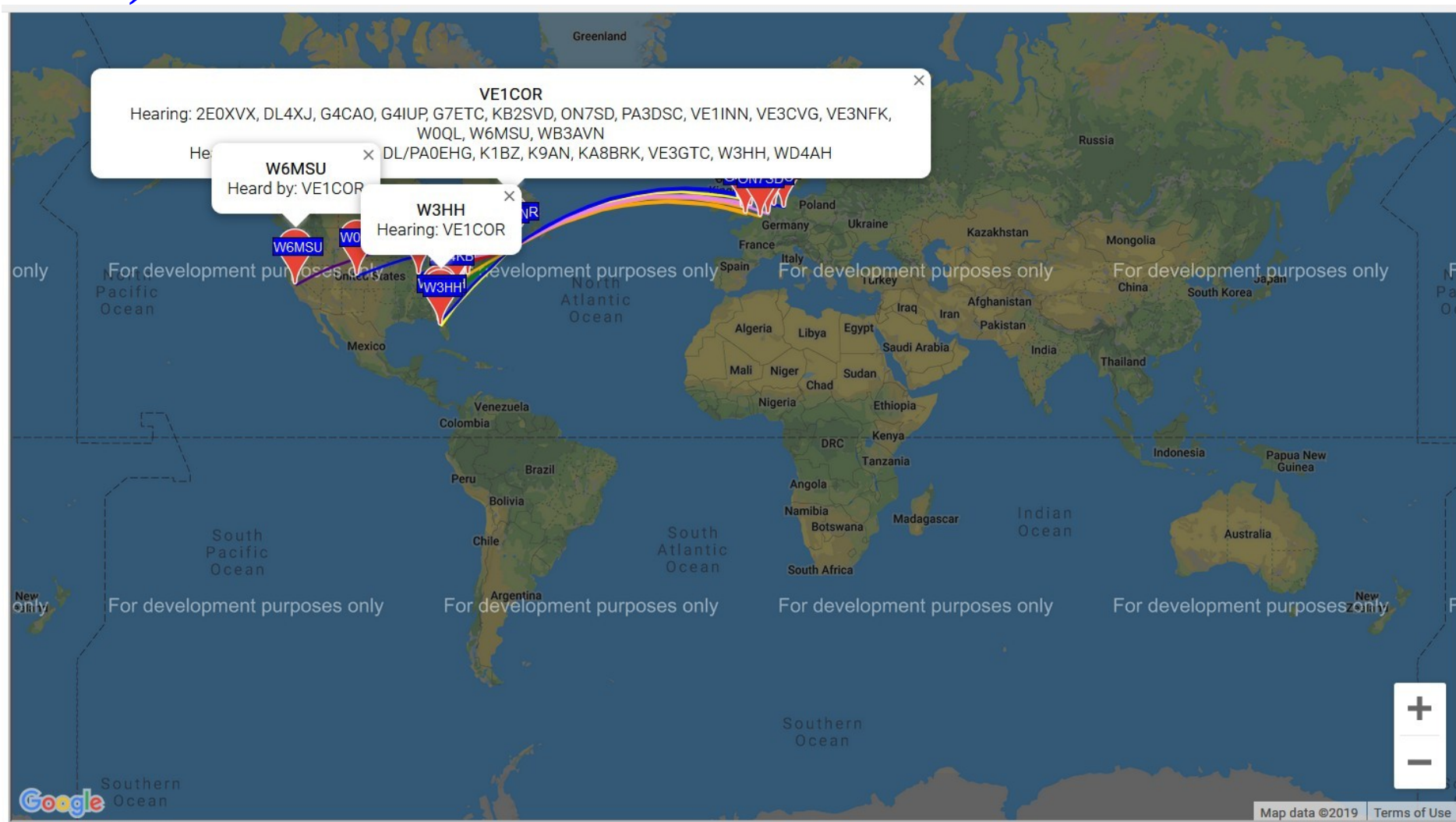
Maximum number of spots limit has been reached (1000). Not all spots for the form limits have been returned

Map data ©2019 Terms of Use

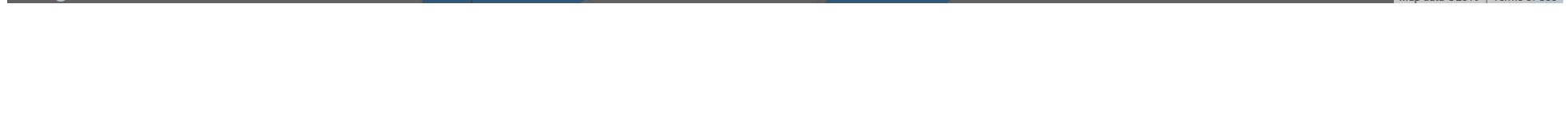
11:06 2019-04-12

Using the WSPRnet.org Map - Continued

Map Filtered for VE1COR (1 watt, previous 10 minutes, 30 metres)

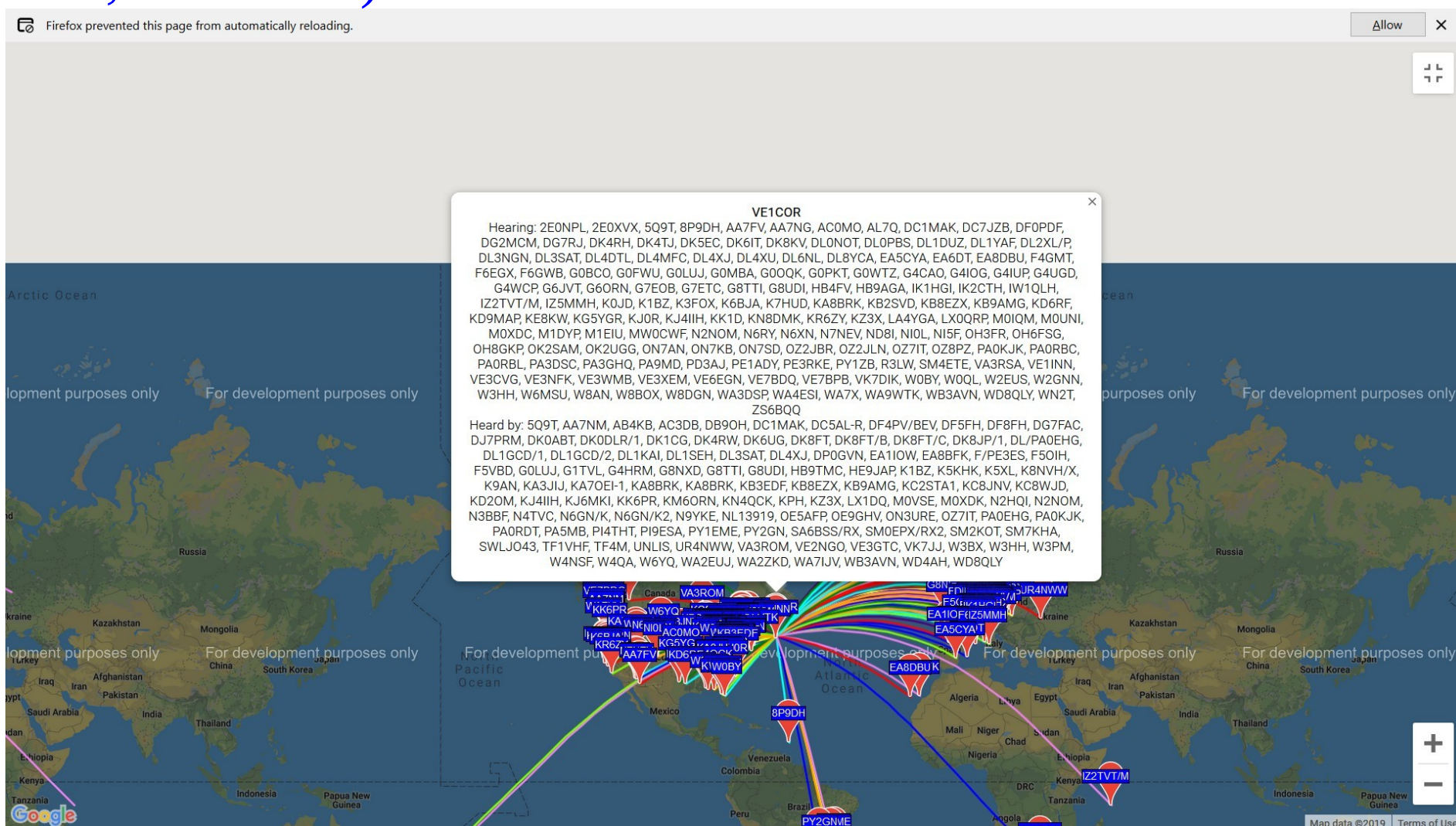


Map Filtered for VE1COR (1 watt, previous 10 hours, 30 metres)



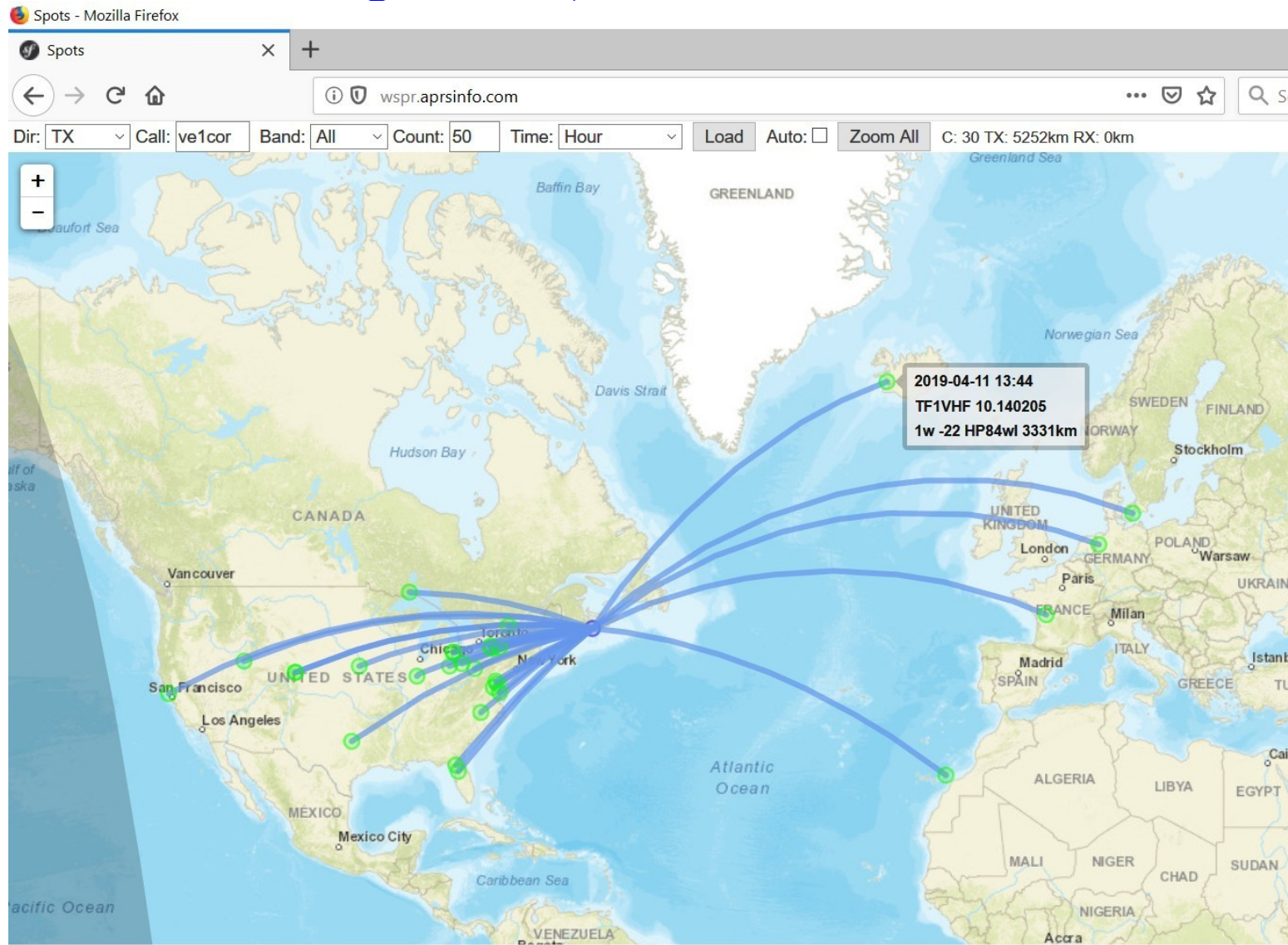
Using the WSPRnet.org Map - Continued

- Continued Map Filtered for VE1COR (1 watt, previous 10 hours, 30 metres)



Using the WSPRnet.org Map - Continued

Alternative WSPR.org MAP (Link at bottom of filter screen)



Showing WSPRnet.org Data

Data Filtered for VE1COR (1 watt, previous 10 hours, 30 metres)

Database | WSPRnet - Mozilla Firefox

Database | WSPRnet

wsprnet.org/drupal/wsprnet/spots

Search

Firefox prevented this page from automatically reloading.

User login

Username *

Password *

Create new account

Request new password

Log in

Frequencies

USB dial (MHz): 0.136, 0.4742, 1.8366, 3.5686, 5.2872, 7.0386, 10.1387, 14.0956, 18.1046, 21.0946, 24.9246, 28.1246, 50.293, 70.091, 144.489, 432.300, 1296.500

Spot Count

1 302 886 417 total

Database

Specify query parameters

50 spots:

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2019-04-11 15:02	VE1COR	10.140196	-7	0	FN84fx	1	K9AN	EN50wc	2077	264
2019-04-11 15:02	VE1COR	10.140197	-20	0	FN84fx	1	K5KHK	FN13dc	1150	265
2019-04-11 15:02	VE1COR	10.140194	-30	0	FN84fx	1	KPH	CM88mc	4892	283
2019-04-11 15:02	VE1COR	10.140196	-27	0	FN84fx	1	N6GN/K2	DN70ll	3389	276
2019-04-11 15:02	VE1COR	10.140288	-27	0	FN84fx	1	K8NVH/X	EN82lm	1586	267
2019-04-11 15:02	VE1COR	10.140196	-20	0	FN84fx	1	VE3GTC	FN25ig	922	276
2019-04-11 15:02	VE1COR	10.140196	+17	0	FN84fx	1	KD2OM	FN12gx	1134	264
2019-04-11 15:02	VE1COR	10.140197	-12	0	FN84fx	1	K1BZ	FM19ne	1273	244
2019-04-11 15:02	VE1COR	10.140163	-21	0	FN84fx	1	F5OIH	JN06ci	4818	64
2019-04-11 15:02	VE1COR	10.140210	-25	0	FN84fx	1	N4TVC	FM18is	1329	244
2019-04-11 15:02	VE1COR	10.140200	-27	0	FN84fx	1	KB8EZX	EN91dk	1520	261
2019-04-11 15:02	VE1COR	10.140196	-23	0	FN84fx	1	VA3ROM	EN58jk	1985	290
2019-04-11 15:02	VE1COR	10.140195	-9	0	FN84fx	1	WA2ZKD	FN13ed	1142	265
2019-04-11 15:02	VE1COR	10.140198	-15	0	FN84fx	1	KA7OEI-1	DN31uo	3904	282
2019-04-11 15:02	VE1COR	10.140198	-10	0	FN84fx	1	WD4AH	EL89rt	2368	231
2019-04-11 15:02	VE1COR	10.140195	-17	0	FN84fx	1	KA8BRK	EN81fc	1677	262
2019-04-11 15:02	VE1COR	10.140218	-6	0	FN84fx	1	WB3AVN	FM19	1266	246
2019-04-11 14:42	VE1COR	10.140196	-23	0	FN84fx	1	EA8BFK	IL38bo	4697	95
2019-04-11 14:42	VE1COR	10.140194	-18	0	FN84fx	1	KB3EDF	FM18rh	1308	240

12:09

2019-04-11

Showing WSPRnet.org Data - Continued

Data Query Filters

Spot Database Query | WSPRnet - Mozilla Firefox

Spot Database Query | WSPRnet X +

← → ↺ 🏠 ⓘ wsprrnet.org/drupal/wsprrnet/spotquery ... 🔒 ☆ 🔍 Search 📑 📄 🔊 ☰

User login

Username *

Password *

[Create new account](#)
[Request new password](#)

Spot Database Query

Band

All ▾

Show only spots on this band.

Count

50

Maximum number of spots to show

Call

ve1cor

Only show spots of this callsign. Use * at the end (only) for wildcard searches.

Timestamp

Call

Reporter reported by this call. If same as "Call", then show spots of this call OR heard by this call. Use * at the end (only) for wildcard searches.

Frequency

SNR

Power

Distance only of this recent time period

Grid

km/Watt

Timestamp ▾

Field to sort by

☒ Reverse

Check to reverse sort order

Frequencies

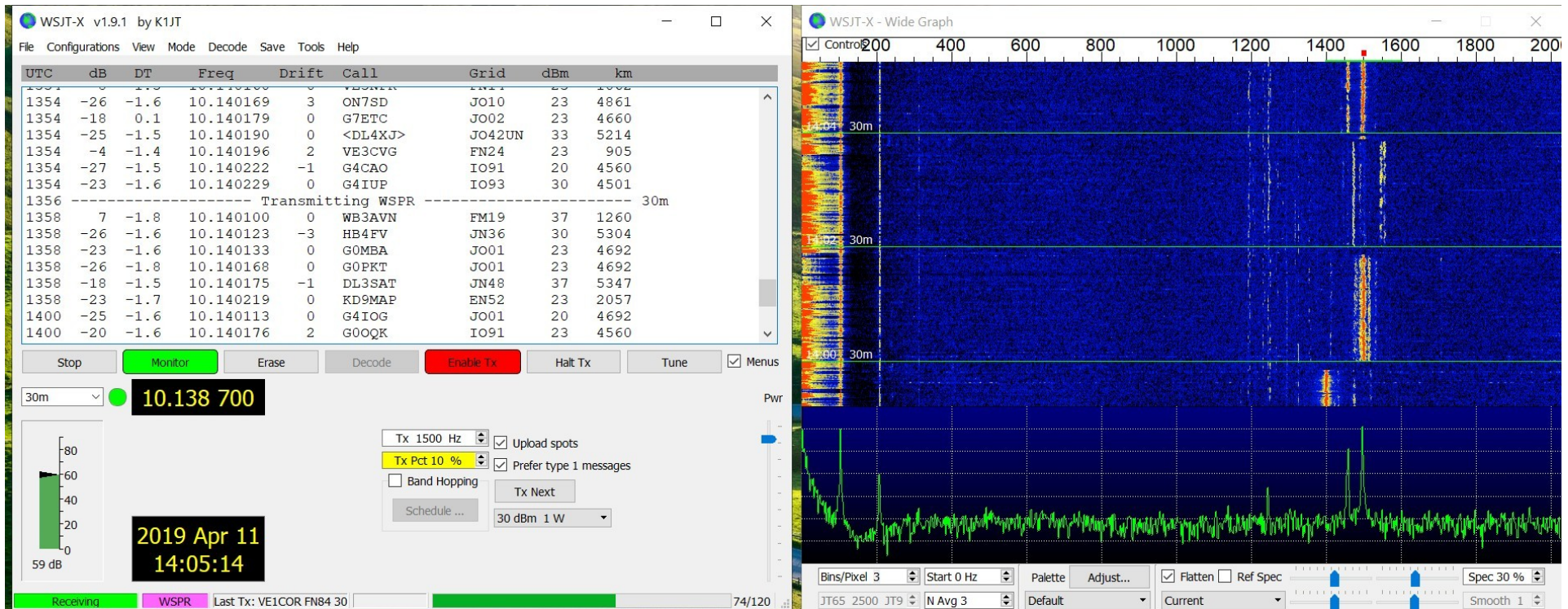
USB dial (MHz): 0.136,
0.4742, 1.8366, 3.5686,
5.2872, 7.0386,
10.1387, 14.0956,
18.1046, 21.0946,
24.9246, 28.1246,
50.293, 70.091,
144.489, 432.300,
1296.500

Spot Count

1,396,375,379 total spots

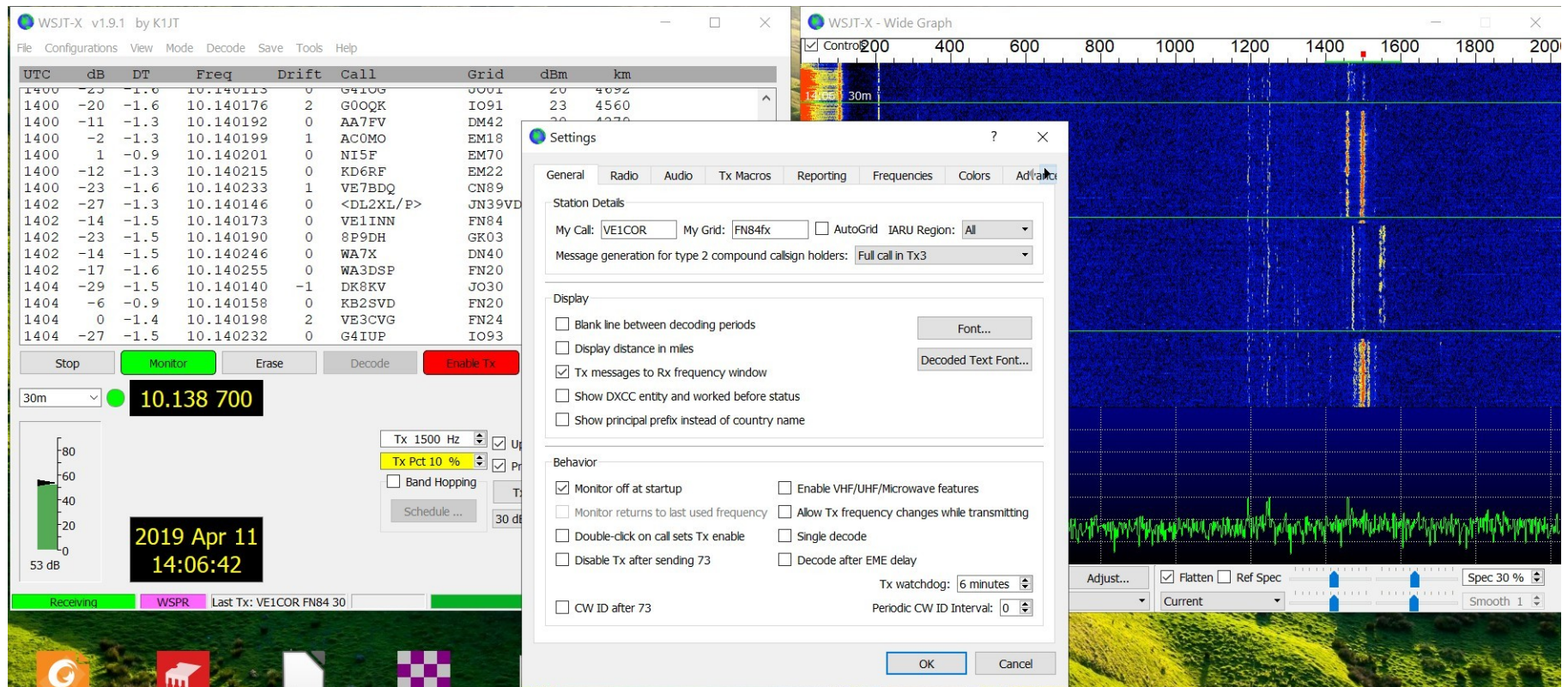
17:32
2019-04-13

6: Using WSPR Program on a PC, MAC, Linux Active Screen (waterfall not optimized)



6: Using WSPR on a PC, MAC, Linux

General Setup Screen (located in File menu)



Using WSPR on a PC, MAC, Linux - Continued

Settings - Audio (for SignalLink)

The screenshot shows the WSJT-X v1.9.1 interface. The main window displays a list of stations with columns for UTC, dB, DT, Freq, Drift, Call, Grid, dBm, and km. The frequency display shows 10.138700 MHz. The wideband graph shows a spectrum from 200 to 2000 kHz. The Settings dialog box is open, showing the Audio tab. The Soundcard section shows Input: Microphone (USB Audio CODEC) and Output: Speakers (USB Audio CODEC). The Save Directory section shows Location: C:/Users/Andrew/AppData/Local/WSJT-X/save. The AzEl Directory section shows Location: C:/Users/Andrew/AppData/Local/WSJT-X. The Remember power settings by band section has checkboxes for Transmit and Tune. The bottom of the main window shows a status bar with 'Receiving', 'WSPR', and 'Last Tx: VE1COR FN84 30'.

UTC	dB	DT	Freq	Drift	Call	Grid	dBm	km
1400	-23	-1.6	10.140113	0	G4IOG	IO01	20	4092
1400	-20	-1.6	10.140176	2	G0OQK	IO91	23	4560
1400	-11	-1.3	10.140192	0	AA7FV	DM42	20	4092
1400	-2	-1.3	10.140199	1	AC0MO	EM18	20	4092
1400	1	-0.9	10.140201	0	NI5F	EM70	20	4092
1400	-12	-1.3	10.140215	0	KD6RF	EM22	20	4092
1400	-23	-1.6	10.140233	1	VE7BDQ	CN89	20	4092
1402	-27	-1.3	10.140146	0	<DL2XL/P>	JN39VD	20	4092
1402	-14	-1.5	10.140173	0	VE1INN	FN84	20	4092
1402	-23	-1.5	10.140190	0	8P9DH	GK03	20	4092
1402	-14	-1.5	10.140246	0	WA7X	DN40	20	4092
1402	-17	-1.6	10.140255	0	WA3DSP	FN20	20	4092
1404	-29	-1.5	10.140140	-1	DK8KV	JO30	20	4092
1404	-6	-0.9	10.140158	0	KB2SVD	FN20	20	4092
1404	0	-1.4	10.140198	2	VE3CVG	FN24	20	4092
1404	-27	-1.5	10.140232	0	G4IUP	IO93	20	4092

Settings

General Radio Audio Tx Macros Reporting Frequencies Colors Advanced

Soundcard

Input: Microphone (USB Audio CODEC) Mono

Output: Speakers (USB Audio CODEC) Mono

Save Directory

Location: C:/Users/Andrew/AppData/Local/WSJT-X/save Select

AzEl Directory

Location: C:/Users/Andrew/AppData/Local/WSJT-X Select

Remember power settings by band

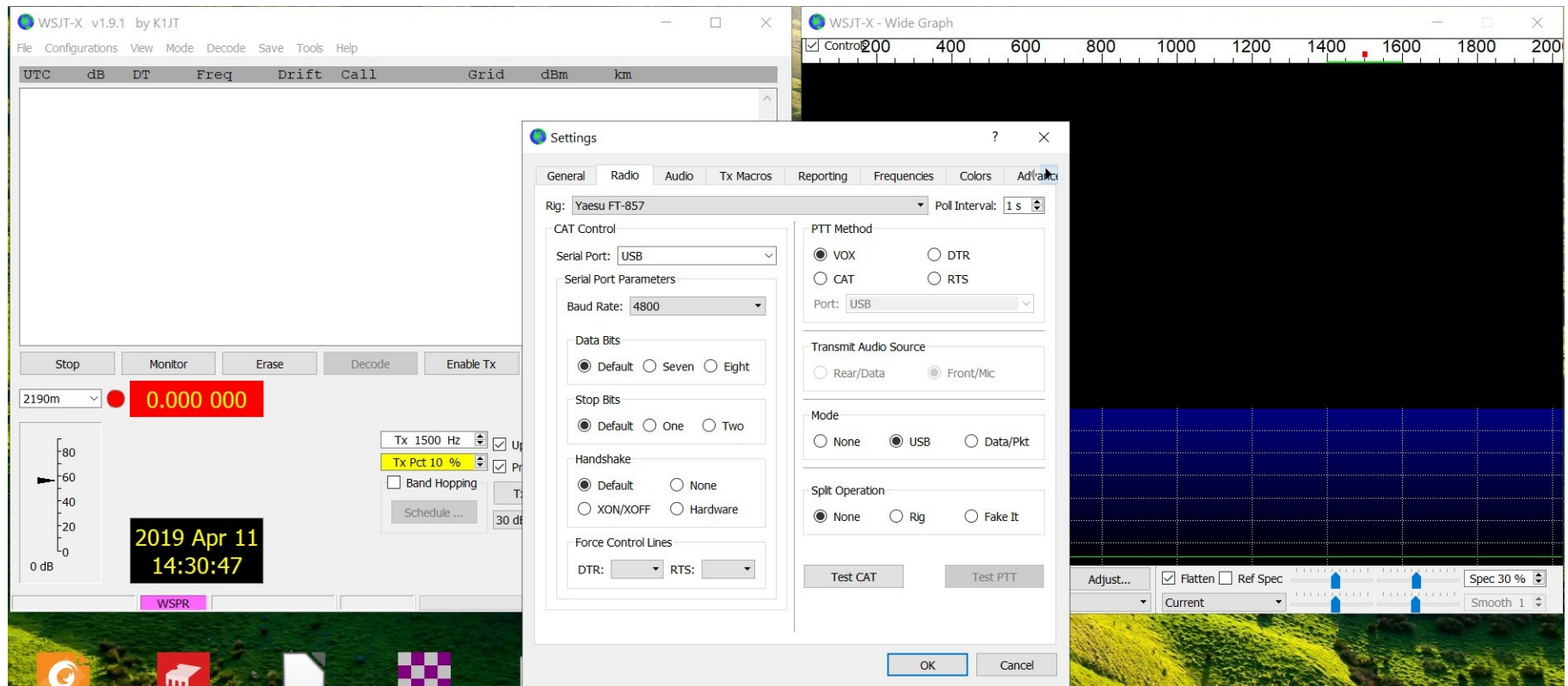
☐ Transmit ☐ Tune

Select tab to change configuration parameters.

OK Cancel

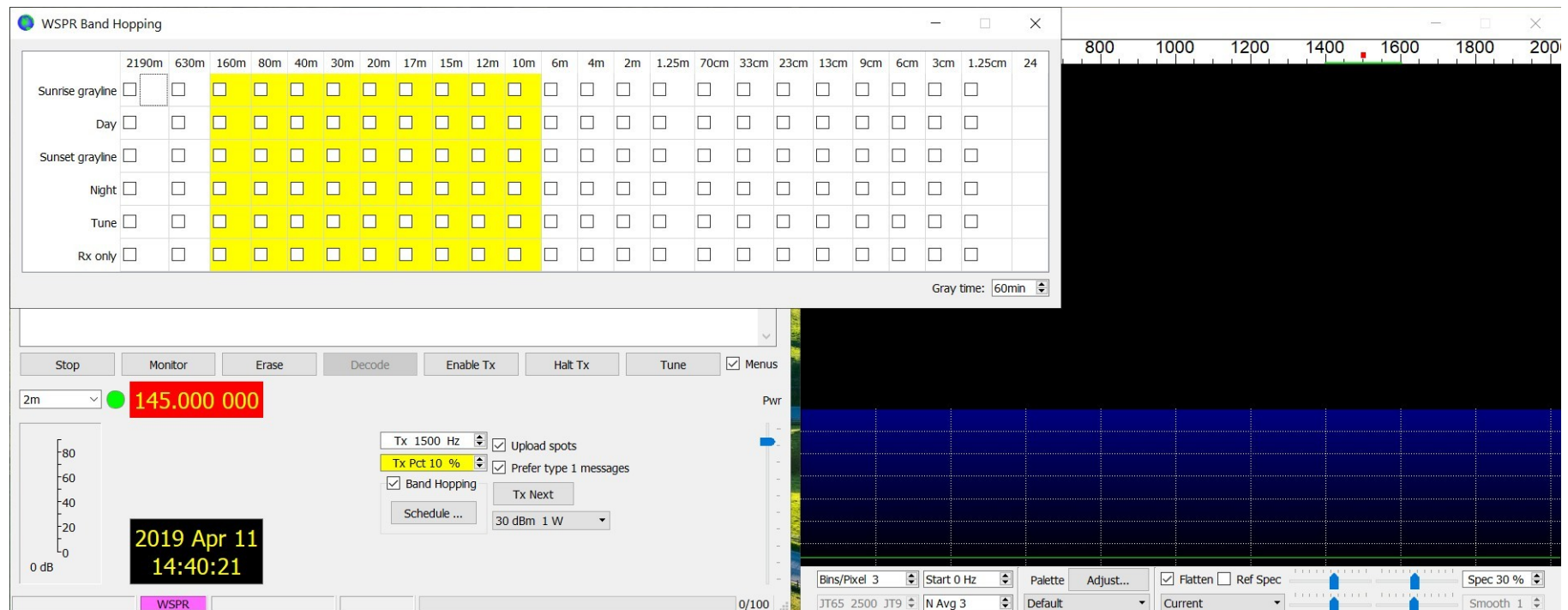
Using WSPR on a PC, MAC, Linux - Continued

Radio Type (optional except for CAT control with Frequency Hopping)



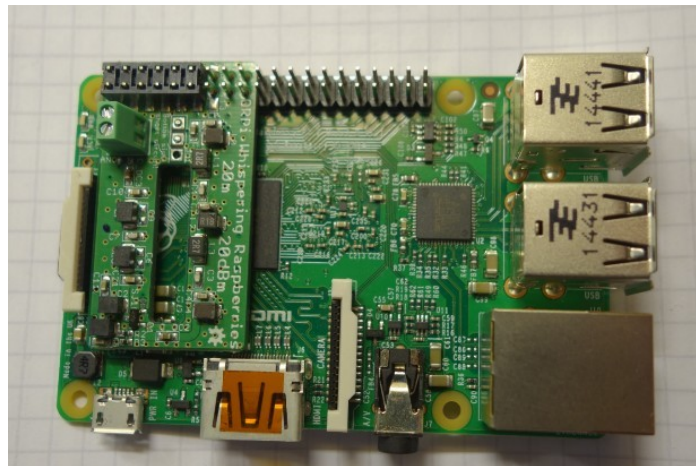
Using WSPR on a PC, MAC, Linux - Continued

Frequency Hopping (for radio with CAT, accessed on Active Screen: check 'Band Hopping' and click on 'Schedule')



7: Three Specialized WSPR Transmitting Devices - with portable capability

1. TAPR 20m Raspberry Pi Shield



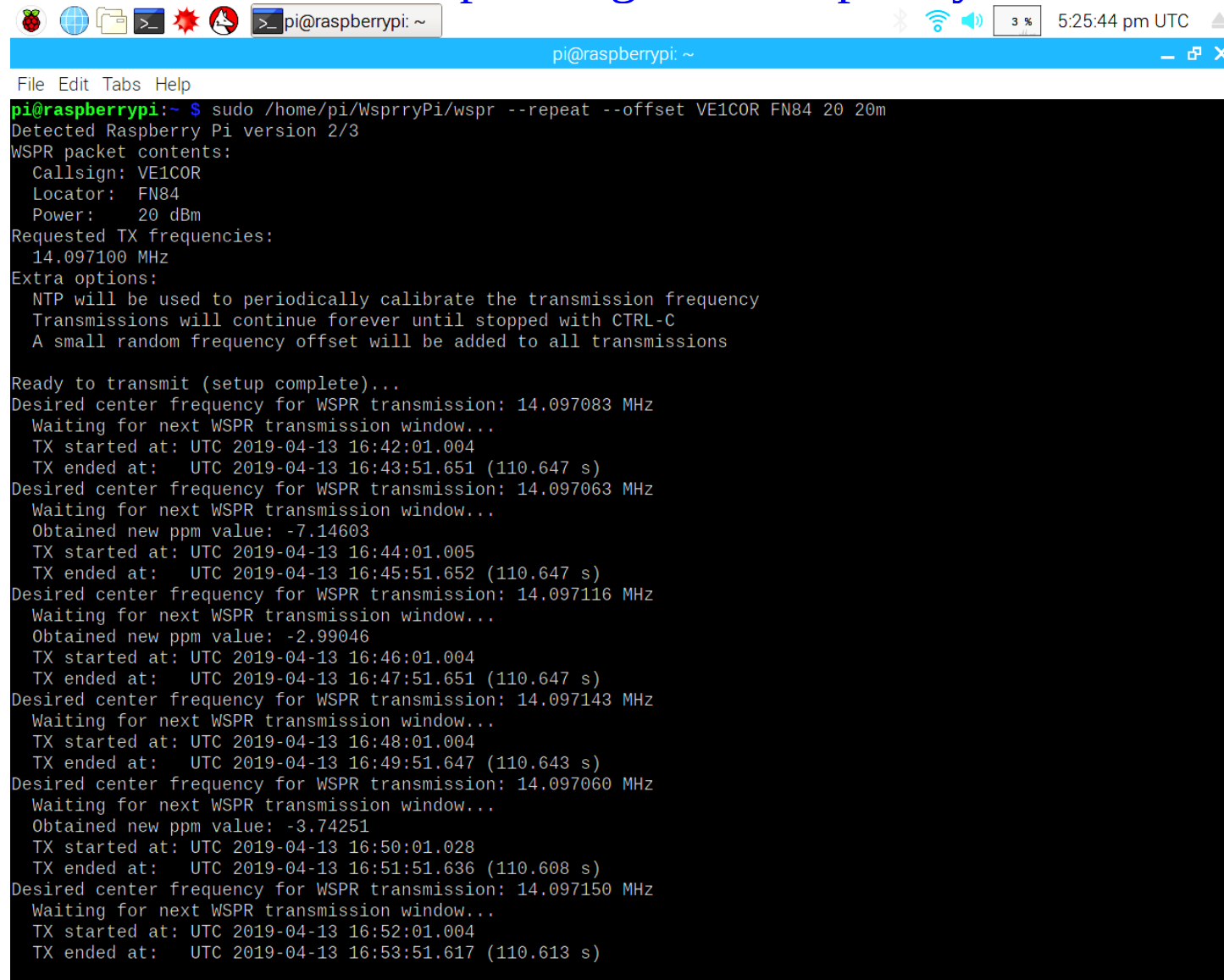
- Available from TAPR (Tucson Amateur Packet Radio Corp.) for \$29US plus shipping
- Plugs onto the bus of a Raspberry Pi models 2*, 3B, or 3B+ (* for Internet needs a USB WiFi dongle or ethernet connection)

TAPR 20m Raspberry Pi Shield - Continued

- 20 metre band WSPR transmitter with integrated low pass filter (source signal is a square wave)
- Transmission output 100 milliwatts (0.1 Watts)
- Automatic frequency adjustment when Network Time Protocol (NTP) server is available via the Internet (WiFi, ethernet)
- Portable capability based on the accuracy of the Raspberry Pi clock.
- Requires 5 volt 1.5 amp or greater power supply
- **The way I command the TAPR 20m Shield it transmits every 2 minutes, not conforming to WSPR etiquette (there may be a command line option that delays transmitting)**

TAPR 20m Raspberry Pi Shield - Continued

TAPR 20m Shield Operating on a Raspberry Pi



The screenshot shows a terminal window on a Raspberry Pi. The title bar reads 'pi@raspberrypi: ~'. The terminal displays the output of the command `sudo /home/pi/WsprryPi/wspr --repeat --offset VE1COR FN84 20 20m`. The output includes WSPR packet details (Callsign: VE1COR, Locator: FN84, Power: 20 dBm), requested TX frequencies (14.097100 MHz), and extra options (NTP calibration, continuous transmissions, random frequency offset). It then shows a series of transmission logs with timestamps and frequencies.

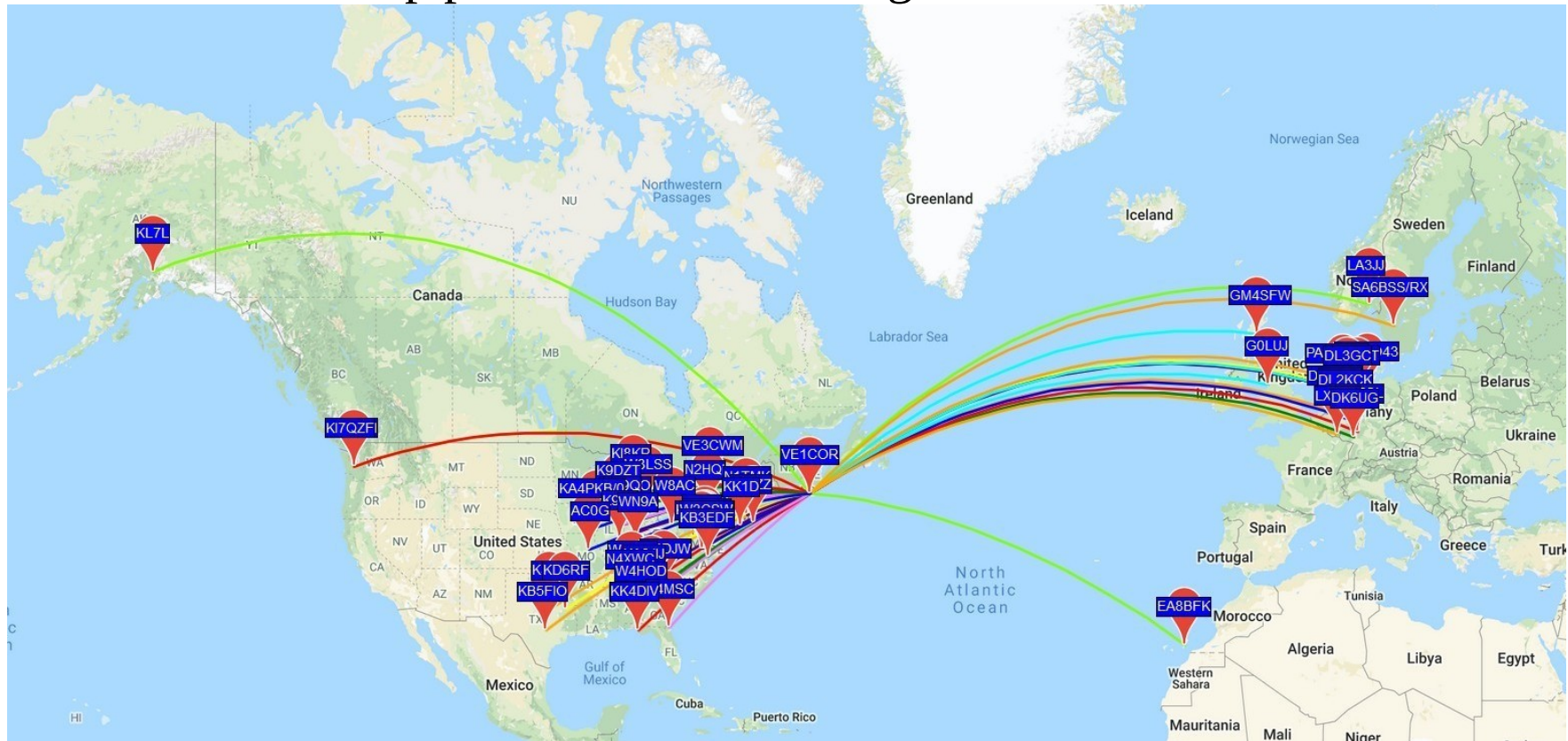
```
pi@raspberrypi:~$ sudo /home/pi/WsprryPi/wspr --repeat --offset VE1COR FN84 20 20m
Detected Raspberry Pi version 2/3
WSPR packet contents:
  Callsign: VE1COR
  Locator:  FN84
  Power:    20 dBm
Requested TX frequencies:
  14.097100 MHz
Extra options:
  NTP will be used to periodically calibrate the transmission frequency
  Transmissions will continue forever until stopped with CTRL-C
  A small random frequency offset will be added to all transmissions

Ready to transmit (setup complete)...
Desired center frequency for WSPR transmission: 14.097083 MHz
Waiting for next WSPR transmission window...
TX started at: UTC 2019-04-13 16:42:01.004
TX ended at:   UTC 2019-04-13 16:43:51.651 (110.647 s)
Desired center frequency for WSPR transmission: 14.097063 MHz
Waiting for next WSPR transmission window...
Obtained new ppm value: -7.14603
TX started at: UTC 2019-04-13 16:44:01.005
TX ended at:   UTC 2019-04-13 16:45:51.652 (110.647 s)
Desired center frequency for WSPR transmission: 14.097116 MHz
Waiting for next WSPR transmission window...
Obtained new ppm value: -2.99046
TX started at: UTC 2019-04-13 16:46:01.004
TX ended at:   UTC 2019-04-13 16:47:51.651 (110.647 s)
Desired center frequency for WSPR transmission: 14.097143 MHz
Waiting for next WSPR transmission window...
TX started at: UTC 2019-04-13 16:48:01.004
TX ended at:   UTC 2019-04-13 16:49:51.647 (110.643 s)
Desired center frequency for WSPR transmission: 14.097060 MHz
Waiting for next WSPR transmission window...
Obtained new ppm value: -3.74251
TX started at: UTC 2019-04-13 16:50:01.028
TX ended at:   UTC 2019-04-13 16:51:51.636 (110.608 s)
Desired center frequency for WSPR transmission: 14.097150 MHz
Waiting for next WSPR transmission window...
TX started at: UTC 2019-04-13 16:52:01.004
TX ended at:   UTC 2019-04-13 16:53:51.617 (110.613 s)
```

TAPR 20m Raspberry Pi Shield - Continued

TAPR 20m Shield WSPR Map (testing autotuned small magnetic loop antenna, 9 Hrs. July 2-3 2018 - 0.1 Watt)

Map produced before Google's deterioration.



2. QRP Labs Ultimate3S QRSS/WSPR kit



- The base module and add-on options are kits
- Main module, synthesizer, one low pass filter: price \$33.00US plus shipping
- Options needed for full WSPR operation: QL1 GPS receiver (\$23US) 6-band Filter Relay switch (\$16US), Low Pass Filters (\$4.50US per band)

QRP Labs Ultimate3S QRSS/WSPR kit - Continued

- U3S enclosure (+\$38.50US)
- Several other beacon modes are also supported, may need additional options
- Maximum transmission power approximately 200 mW
- Time and location information provided automatically by GPS
- Operates without external computer connection at any time
- Set up for callsign, frequency, power output, etc. is entered by two push button switches
- Requires 5 volt power supply while operating

QRP Labs Ultimate3S QRSS/WSPR kit - Continued

- Here is what happened when, by mistake, I connected a 12 volt power supply to the Ultimate3s during testing ...

GOODBYE Ultimate3S QRSS/WSPR kit



3.

SOTABEAMS WSPRLite Flexi Antenna Performance Analysis System



It is small: 40 x 50 x 10 mm

- Price \$107.98 CDN
- Low Pass Filters needed for each band (output is raw square wave), \$18.12 for PCB, plus \$7.60 per band (note, any suitable low pass filter selection can be used)

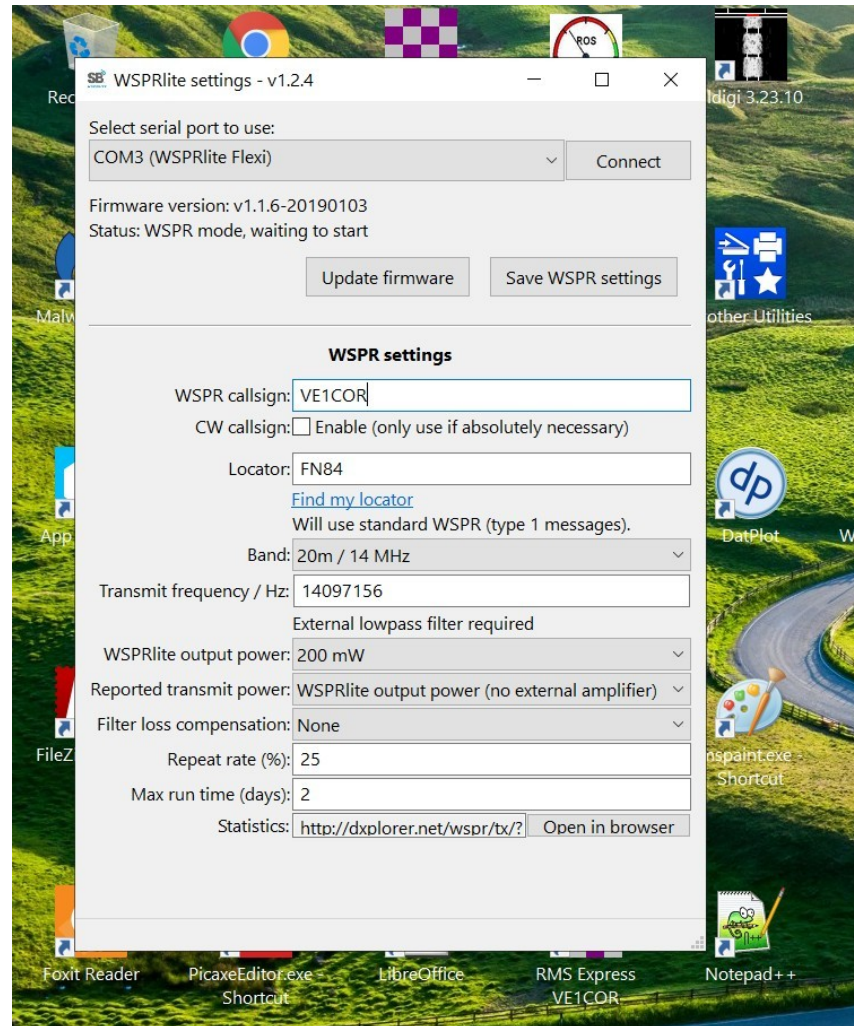
SOTABEAMS WSPRLite Flexi Antenna Performance Analysis System

- Continued

- Maximum transmission power 200 mW (100 mW on 6 metres)
- Covers 630 metres to 6 metres
- Computer or tablet is used to program callsign, maidenhead location, band (freq.), repeat rate. After being programmed WSPRlite may be disconnected and settings are retained
- "Interference Avoidance Algorithm"
- Requires 5 volt power supply while operating
- Timing set by pressing a button on the device at the beginning of an even two-minute segment. Once set timing is supposed to be accurate for 45 days or as long as power is maintained

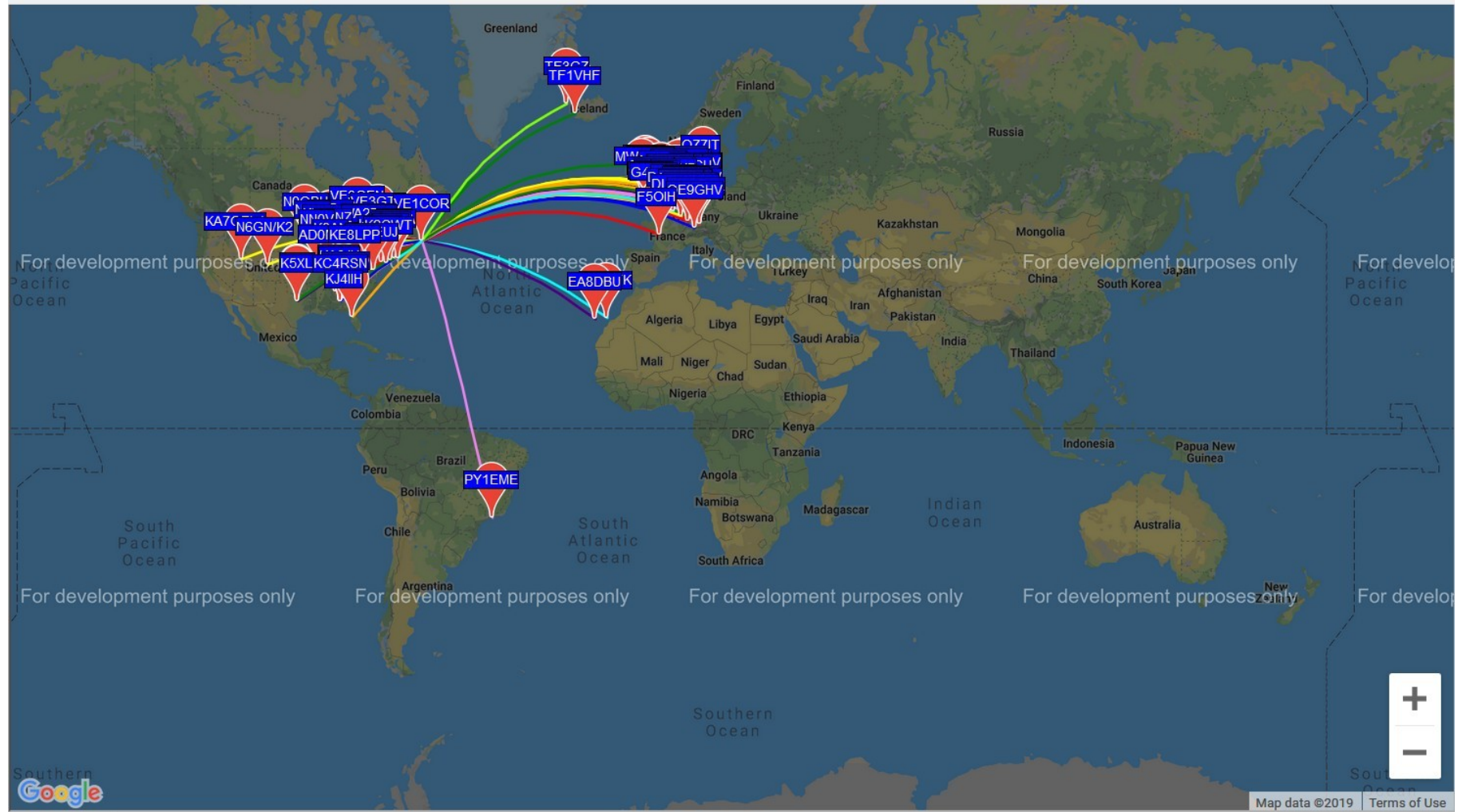
SOTABEAMS WSPR Lite Flexi Antenna Performance Analysis System - Continued

Programming WSPR Lite Flexi with a PC running 'WSPR Lite Config' Utility



SOTABEAMS WSPR Lite Flexi Antenna Performance Analysis System - Continued

WSPR Lite Flexi Map 1 (Transmitting Only: 0.2 watts - effective 0.1 watt with transmission line loss - previous 6 hours, 20 metres. Hustler 6BTV Antenna)



8: Dedicated WSPR Monitor / Receiver Using a Raspberry Pi 3 (or later) and a RTL-SDR, Software Defined Radio, Dongle Receiver

- Here are the parts:



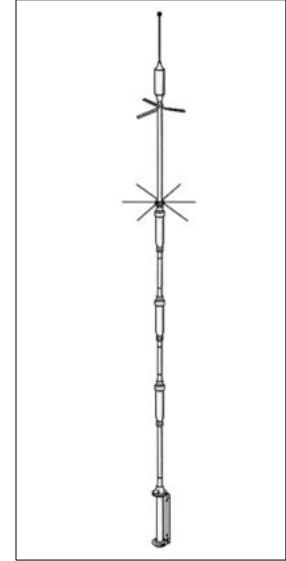
**Raspberry Pi
3 or later**



**RTL-SDR V3
R820T2 RTL2832U**



**Monitor, Mouse,
Keyboard**



HF Antenna

Others: Pi 5V power supply, Pi case, various cable connectors

- The RTL-SDR V3 has a frequency range of about 500KHz to 28MHz in this mode.

8: Dedicated WSPR Monitor / Receiver Using a Raspberry Pi 3 . . . continued

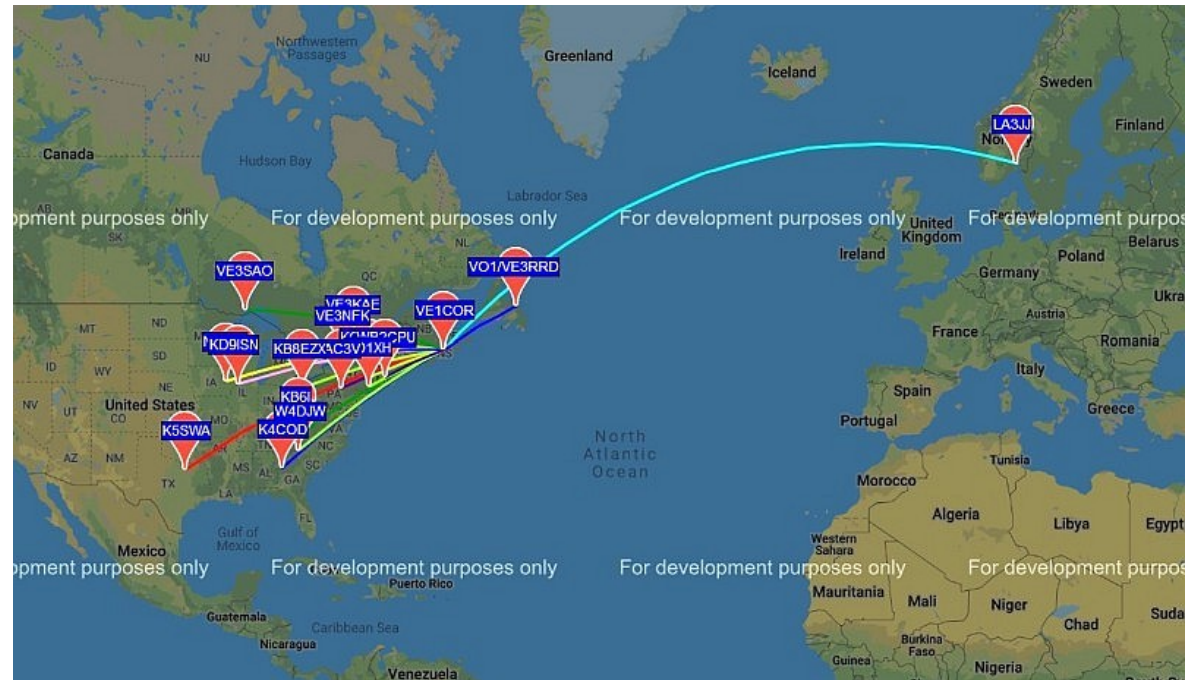
The results (a few minutes list for the Pi, 10 minutes for the Map)

```
File Edit Tabs Help
pi@raspberrypi:~ $ bash wspr
Found 1 device(s):
  0: Realtek, RTL2838UHIDIR, SN: 00000001

Using device 0: Generic RTL2832U OEM
Found Rafael Micro R820T tuner
Enabled direct sampling mode, input 2

Starting rtl-sdr-wsprd (2019-07-24, 14:47z) -- Version 0.2
  Callsign   : VE1COR
  Locator    : FN84FX
  Dial freq. : 14095599 Hz
  Real freq. : 14095599 Hz
  PPM factor  : 0
  Auto gain   : enable
Wait for time sync (start in 18 sec)

Allocating 15 zero-copy buffers
Spot : -8.80 -0.27 14.097165 -4 NF10 FN33 20
Spot : -11.53 -0.91 14.097031 1 KB8EZ EN91 37
Spot : -14.94 -0.91 14.097040 0 AC3V FN11 20
Spot : -16.05 -0.87 14.097174 0 VA3UAL EN94 27
Spot : -17.07 -1.81 14.097058 0 KS0FT/0 37
Spot : -17.48 -0.02 14.097076 0 VA3QF FN02 23
Spot : -18.77 -0.85 14.097147 0 G0CCL J002 37
Spot : -3.59 -0.91 14.097122 0 VE3PRO EN94 33
Spot : -12.09 -0.87 14.096998 0 KD1XH FN31 37
Spot : -15.51 0.75 14.097066 0 <...> GN28 23
Spot : -17.39 -0.95 14.097078 0 KC2RFU FN32 20
Spot : -18.19 -0.63 14.097160 1 WB2CPU FN42 23
Spot : -21.92 -0.81 14.097147 0 G0CCL J002 37
Spot : -22.83 -0.95 14.097099 1 AC3V FN11 20
Spot : -1.26 -0.87 14.096998 0 KD1XH FN31 37
Spot : -10.19 -0.78 14.097182 0 K4COD EM73 33
Spot : -12.79 0.79 14.097121 1 VE3SAO EN58 23
Spot : -15.18 -0.89 14.097060 0 KC2RFU FN32 20
Spot : -16.45 -1.15 14.097159 1 KD9ISN EN41 23
```



This is what shows when the RTL-SDR / Raspberry Pi WSPR Monitor is run successfully

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Software

- Raspberry Pi standard operating system: Raspbian Stretch

NOTE: In mid-2020 I successfully installed RTL-SDR WSPR in a Raspberry Pi 3 using the latest version of Raspbian, called 'Buster'. Raspbian is Raspberry Pi's standard operating system, which has newer versions from time-to-time. In January 2021 the then latest modification of Buster did not support RTL-SDR WSPR. However, a subsequent install in a Raspberry Pi 4 running an even newer update of Buster is working well.

Installation steps provided by Zoltan. Copy commands below and paste them into the Terminal to run. (Note, I ignore step 3 - my monitor is VGA with an HDMI to VGA converter, also I have not used tmux.)

Terminal procedure for setting up RTL-SDR WSPR Monitor in a Raspberry Pi, by Zoltan at www.rfsparkling.com (also youTube)

Copied from: <http://rfsparkling.com/blog/2018/12/21/making-a-standalone-wspr-receiver-using-raspberry-pi-and-rtl-sdr-v3-dongle-with-rtl-sdr-wsprd-software/>

1. Install necessary dependencies

-> installing tmux is optional, needed for having multiple terminals (optional but recommended even for standalone operation without SSH terminal)

```
sudo apt-get install build-essential cmake libfftw3-dev curl libcurl4-gnutls-dev ntp libusb-1.0-0-dev librtlsdr-dev git tmux
```

#2. Cloning the rtlsdr-wsprd repository and building it

```
git clone https://github.com/Guenael/rtlsdr-wsprd
cd rtlsdr-wsprd/
sudo make
```

#3. Turning off HDMI for less local EMI (I don't do this because I want to see RTL-SDR WSPR in action.)

```
/opt/vc/bin/tvservice -o
```

#4. A reboot is required here to make the rtl-sdr dongle function; the reboot command is:

```
sudo reboot
```

Or simply turn OFF the Raspberry Pi, then turn it back on.

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RUNNING WSPR MONITOR

WSPR is run in the terminal. The command line structure is

Use: rtl_sdr_wsprd -f frequency -c callsign -l locator [options]

-f dial frequency [(k,M) Hz], check <http://wsprnet.org/> for freq.

-c your callsign (12 chars max)

-l your maidenhead locator grid (6 chars max)

Receiver extra options:

-g gain [0-49] (default: 29)

-a auto gain (default: off)

-o frequency offset (default: 0)

-p crystal correction factor (ppm) (default: 0)

-u upconverter (default: 0, example: 125M)

-d direct sampling [0,1,2] (default: 0, 1 for I input, 2 for Q input)

Decoder extra options:

-H do not use (or update) the hash table

-Q quick mode, doesn't dig deep for weak signals

-S single pass mode, no subtraction (same as original wsprd)

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RUNNING WSPR MONITOR - continued

It is simpler than it looks . . .

Assume: call sign is VA9OOO
 maidenhead Locator Grid is FN11XY
 WSPR receive frequency is for 40 metres

In the default terminal directory (pi@raspberrypi:~ \$) enter:

first `cd ~/rtlsdr-wsprd`

then `./rtlsdr_wsprd -f 7.038600M -c VA9OOO -l FN11XY -a 1 -d 2 -p 0 -S`

Commands may be run from a 'Bash' terminal command, with a new file for each frequency. Example for 40 metres below (enter your call sign and maidenhead):

Bash file stored in **/home/pi** with the name: `wspr40.sh`

```
#!/bin/sh
```

```
cd ~/rtlsdr-wsprd
```

```
./rtlsdr_wsprd -f 7.038600M -c VA9OOO -l FN11XY -a 1 -d 2 -p 0 -S
```

In the default terminal directory run this command:

```
bash wspr40.sh
```

* * * * *

GOOD LUCK AND HAVE FUN WITH WSPR!