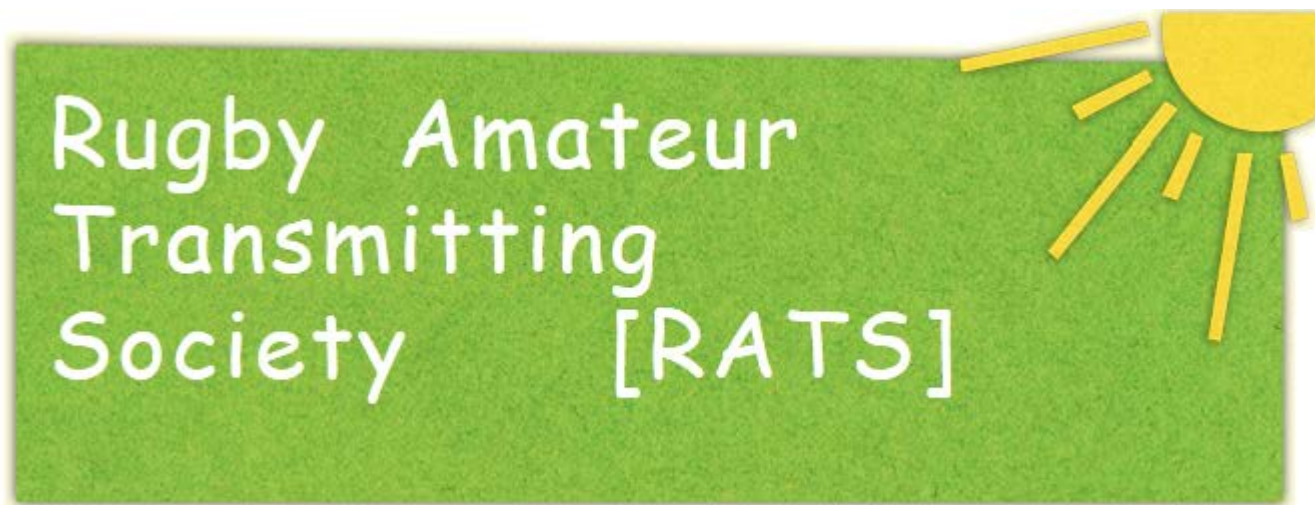




Experimenting with WSPR using Raspberry Pi

2017 2019 2020 2022 2024

Ian M0IJS



WSPR & Raspberry Pi

- WSPR “Whisper”

Weak Signal Propagation Reporter

[https://en.wikipedia.org/wiki/WSPR_\(amateur_radio_software\)](https://en.wikipedia.org/wiki/WSPR_(amateur_radio_software))



- Raspberry Pi

A very convenient computing platform



A summary overview showing how to get running with WSPR using a Raspberry Pi

Requirements:

- Raspberry Pi. We're using model B Version3
- SD card with Raspbian image
- TAPR / WSPR board

https://www.tapr.org/kits_20M-wspr-pi.html

- Software project

<https://github.com/JamesP6000/WsprryPi/>



Bill of Materials – May 2017



RS Part	Description	Cost
896-8660	Raspberry Pi Model B	32.99
909-8132	Official Raspberry Pi 3 B Case	5.50
909-8126	Raspberry Pi official PSU	6.50
Amazon	SanDisk 16GB microSD	6.50
TAPR	20M WSPR shield	25.00
Total		£76.49



Prepare the system

Obtain the latest Raspbian image from [raspberrypi.org](https://www.raspberrypi.org). Write this to an SD card and place a blank file in the root called 'ssh'. This will enable headless operation using SSH. Since November 2016 SSHd has been disabled by default. On boot, the platform looks for the file 'ssh' and starts the SSH server if found.

https://downloads.raspberrypi.org/raspbian_latest

RASPBIAN JESSIE WITH PIXEL

Image with PIXEL desktop based on Debian Jessie

Version: April 2017

Release date: 2017-04-10

Kernel version: 4.4

Either login remotely or connect a keyboard and screen locally.



Update the system & Install project

Get upto date:

sudo apt-get update && sudo apt-get dist-upgrade

An indication of requirements:

16 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.

Need to get 90.0 MB of archives.

After this operation, 4,517 kB of additional disk space will be used.

The project is hosted on github and we 'clone' the files from this as follows:

cd ~

git clone https://github.com/JamesP6000/WsprryPi.git

Now make the program:

cd WsprryPi

make



Update the system & Install project

Get upto date:

sudo apt-get update && sudo apt-get dist-upgrade

An indication of requirements:

16 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.

Need to get 90.0 MB of archives.

After this operation, 4,517 kB of additional disk space will be used.

Do not make this step. We all normally do, but on reboot the WSPR application will not work. This issue will likely get resolved quickly.

**Works fine with a stock
Raspbian 2017-04-10**

The project is hosted on github and we 'clone' the files from this as follows:

cd ~

git clone https://github.com/JamesP6000/WsprryPi.git

Now make the program:

cd WsprryPi

make



Try it out!

Hopefully the files compile cleanly and we can now try it out. Assemble hardware and connect a long wire & ground to the antenna connection.

mycall = callsign

myloc = locator

Using these parameters, 10dBm (10mW) 20Mtr band:

```
pi@raspberrypi:~/WsprryPi $ sudo ./wspr -r -o -s mycall myloc 10 20m
```

Detected Raspberry Pi version 2/3

WSPR packet contents:

Callsign: M0IJS

Locator: IO92II

Power: 10 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



WSPR Transmitting...

Ready to transmit (setup complete)...

Desired center frequency for WSPR transmission: 14.097146 MHz

Waiting for next WSPR transmission window...

Obtained new ppm value: -5.82245

TX started at: UTC 2017-05-03 13:08:01.002

TX ended at: UTC 2017-05-03 13:09:51.685 (110.683 s)

Desired center frequency for WSPR transmission: 14.097042 MHz

Waiting for next WSPR transmission window...

Obtained new ppm value: -6.50426

TX started at: UTC 2017-05-03 13:10:01.003

TX ended at: UTC 2017-05-03 13:11:51.685 (110.682 s)

Desired center frequency for WSPR transmission: 14.097056 MHz

Waiting for next WSPR transmission window...

TX started at: UTC 2017-05-03 13:12:01.001

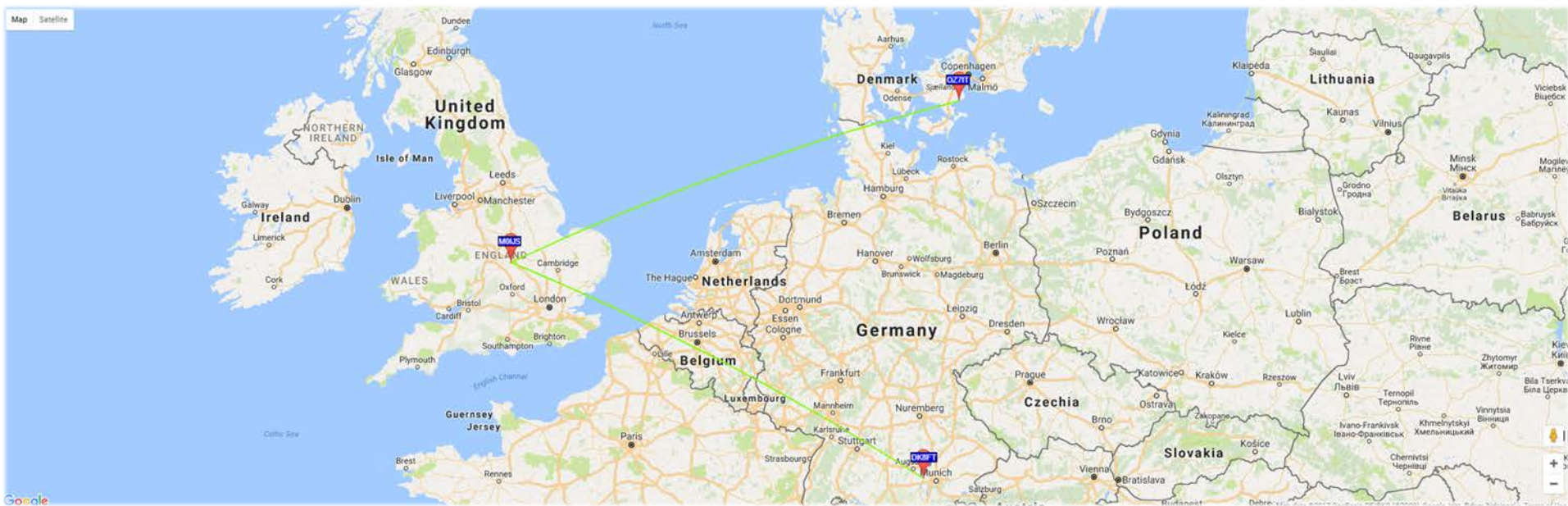
^CExiting with error; caught signal: 2

pi@raspberrypi:~/WsprryPi \$



Resultant Map – May 2017

First transmission

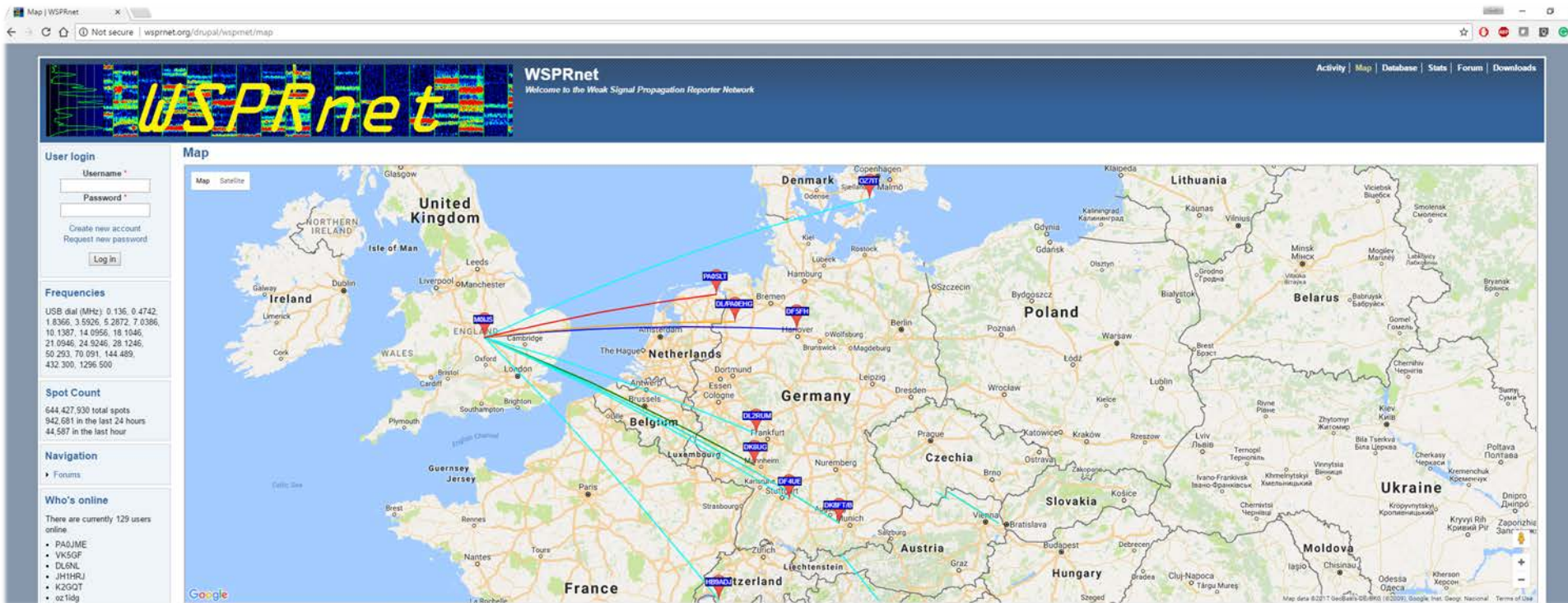


<http://wspnnet.org/drupal/wspnnet/map>



Resultant Map – May 2017

After 10 minutes, 100mW Tx

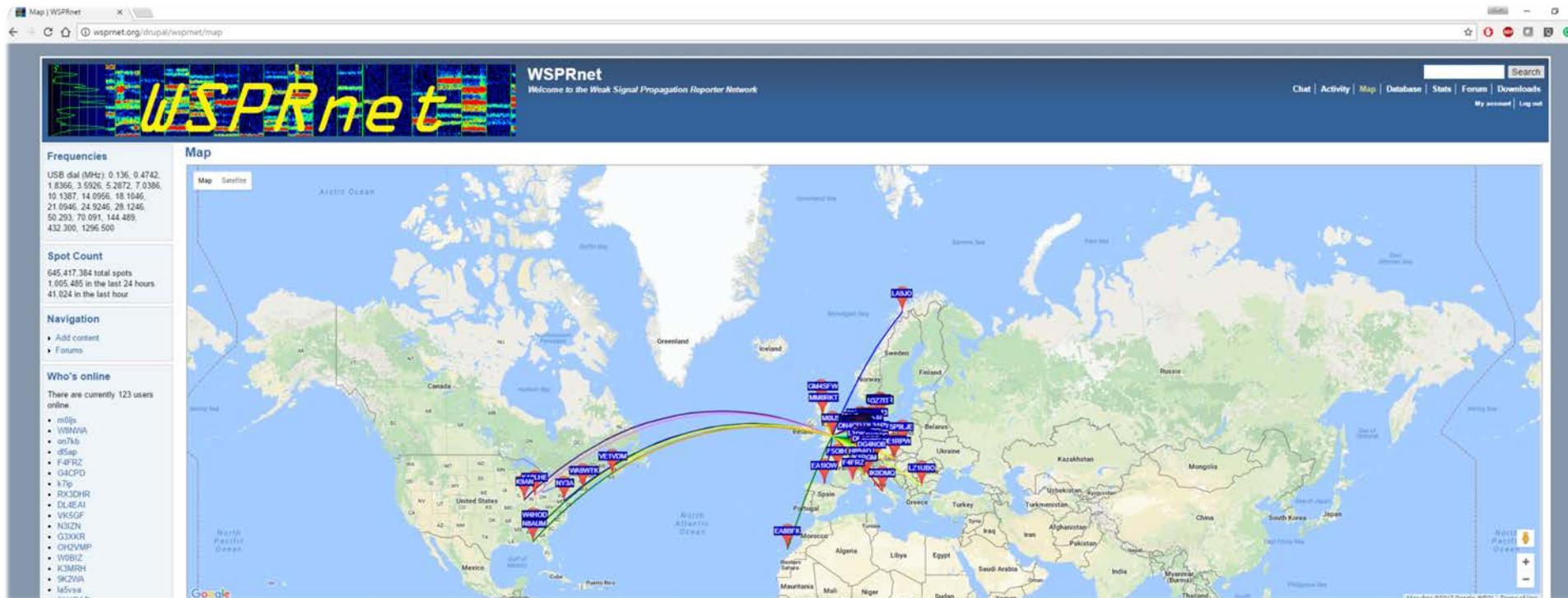


<http://wsprrnet.org/drupal/wsprrnet/map>



Resultant Map – May 2017

After 24hrs, 100mW Tx

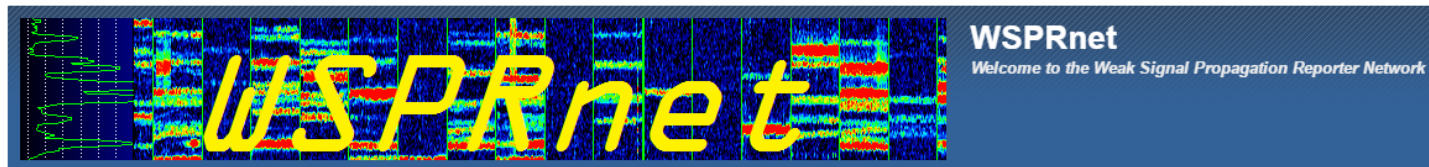


<http://wsprrnet.org/drupal/wsprrnet/map>



Dataset – May 2017

- 500 Spots recorded
- 66 Unique spots
- Best DX: N8AUM, 7005KM



Database

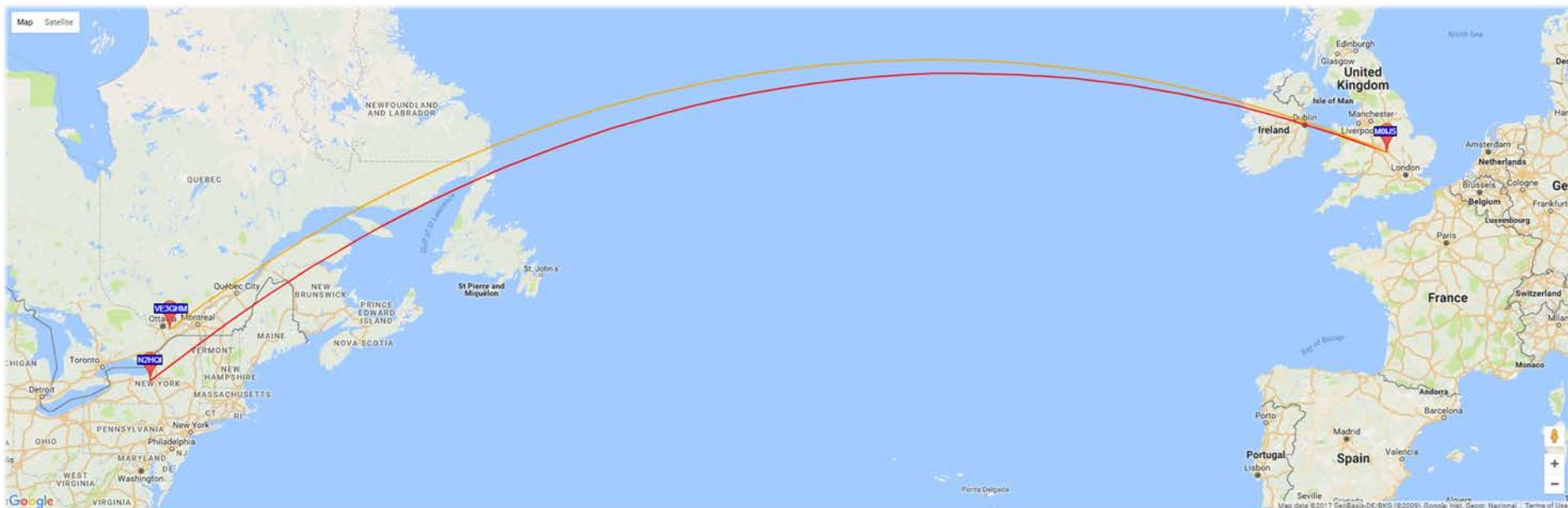
Specify query parameters

66 spots:

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2017-05-03 21:42	M0IJS	14.097057	-22	0	IO92ii	0.1	N8AUM	EM70em	7005	286
2017-05-04 11:14	M0IJS	14.097073	-28	0	IO92ii	0.1	W4HOD	EM72eo	6836	287
2017-05-03 18:52	M0IJS	14.097157	-27	0	IO92ii	0.1	K9AN	EN50wc	6405	295
2017-05-03 22:28	M0IJS	14.097156	-25	0	IO92ii	0.1	KA9LHE	EN70lx	6148	294
2017-05-03 18:06	M0IJS	14.097030	-32	0	IO92ii	0.1	NY3A	FM19	5751	288
2017-05-03 21:10	M0IJS	14.097117	-24	0	IO92ii	0.1	WA9WTK	FN42fk	5186	287
2017-05-03 21:42	M0IJS	14.097075	-20	0	IO92ii	0.1	VE1VDM	FN85ij	4457	286
2017-05-04 06:26	M0IJS	14.097158	-23	0	IO92ii	0.1	EA8BFBK	IL38bo	2838	206
2017-05-04 10:06	M0IJS	14.097057	-27	0	IO92ii	0.1	LA9JO	JP99gb	2126	22
2017-05-04 07:10	M0IJS	14.097088	-17	-1	IO92ii	0.1	LZ1UBO	KN12	2114	112



Example Spots - 20170517



1Hr dataset

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2017-05-26 23:12	M0IJS	14.097004	-15	0	IO92ii	0.1	N2HQL	FN13sa	5461	291
2017-05-26 23:10	M0IJS	14.097000	-24	0	IO92ii	0.1	N2HQL	FN13sa	5461	291
2017-05-26 23:10	M0IJS	14.097061	-24	0	IO92ii	0.1	VE3GHM	FN25ig	5235	293
2017-05-26 22:56	M0IJS	14.097045	-21	0	IO92ii	0.1	N2HQL	FN13sa	5461	291
2017-05-26 22:52	M0IJS	14.097097	-24	-1	IO92ii	0.1	N2HQL	FN13sa	5461	291
2017-05-26 22:50	M0IJS	14.097032	-1	0	IO92ii	0.1	TF4M	HP85fp	1930	328
2017-05-26 22:38	M0IJS	14.097116	-26	0	IO92ii	0.1	N2HQL	FN13sa	5461	291



Revisiting WSPR using Raspberry Pi – July 2019

- App no longer compiles

Solution: Build on an older version of Raspbian

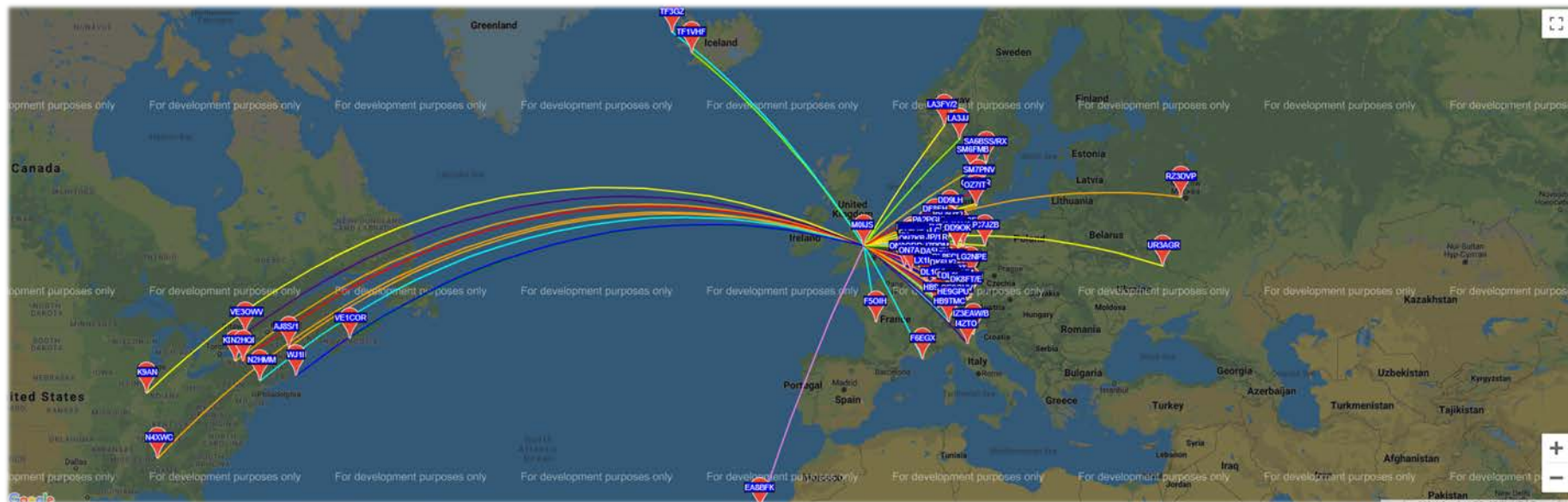
- App crashes

Solution: Run the app within a loop

```
pi@raspberrypi: ~  
pi@raspberrypi:~ $ cat wspr_loop.sh  
#!/bin/bash  
loop_ctr=0  
while true  
do  
    ((loop_ctr++))  
    echo "Script loop: "$loop_ctr  
    sudo ./wspr -s -r -o mycall myloc 20 20m  
done  
pi@raspberrypi:~ $
```



Example Spots - 20190720

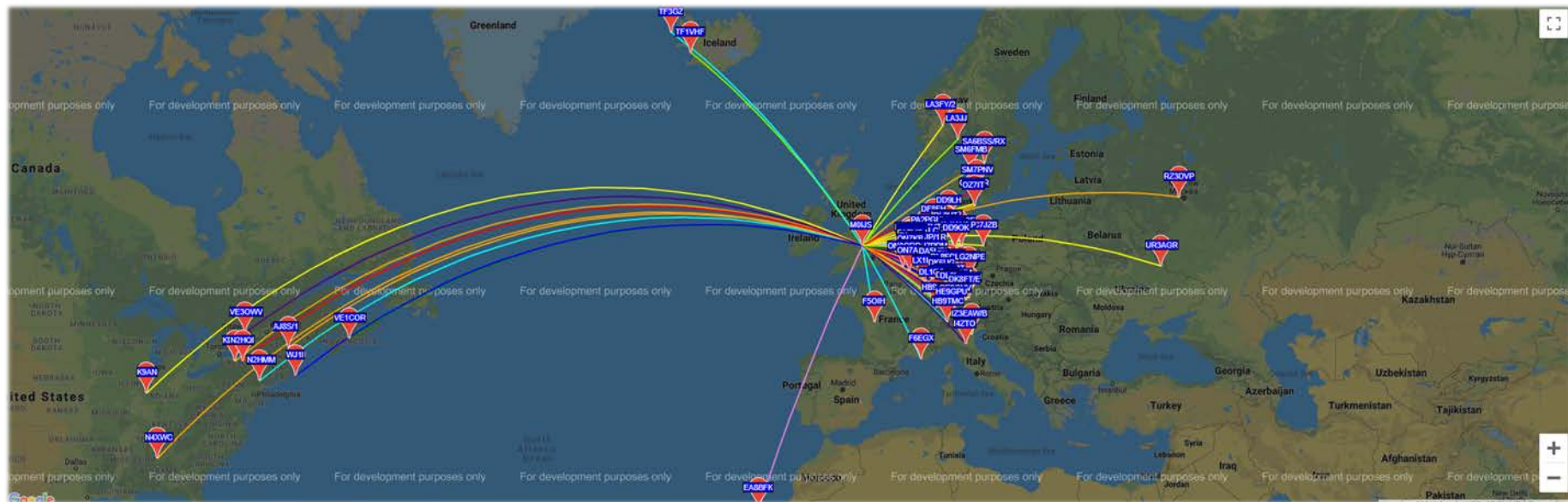


Best dx

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2019-07-19 23:36	M0IJS	14.097036	-28	0	IO92ii	0.1	N4XWC	EM63nt	6820	289
2019-07-20 00:12	M0IJS	14.097079	-26	0	IO92ii	0.1	K9AN	EN50wc	6405	295
2019-07-19 23:58	M0IJS	14.097174	-28	0	IO92ii	0.1	KD2OM	FN12gx	5528	291
2019-07-19 22:46	M0IJS	14.097158	-25	0	IO92ii	0.1	KD2OM	FN12gx	5528	291
2019-07-19 22:58	M0IJS	14.097131	-23	0	IO92ii	0.1	KD2OM	FN12gx	5528	291
2019-07-19 22:44	M0IJS	14.097064	-25	0	IO92ii	0.1	KD2OM	FN12gx	5528	291
2019-07-19 23:56	M0IJS	14.097040	-25	0	IO92ii	0.1	KD2OM	FN12gx	5528	291



Example Spots - 20190720



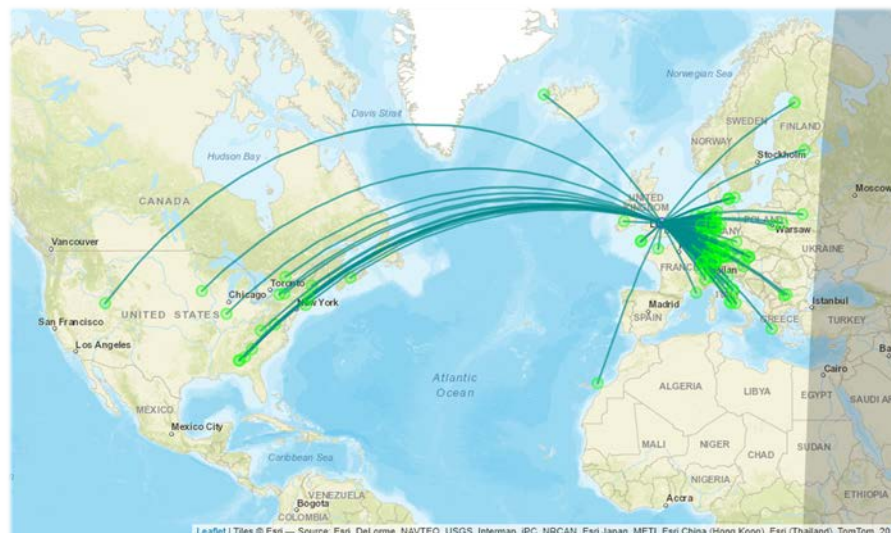
Best dx

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2019-07-19 23:36	M0IJS	14.097036	-28	0	IO92ii	0.1	N4XWC	EM63nt	6820	289
2019-07-20 00:12	M0IJS	14.097079	-26	0	IO92ii	0.1	K9AN	EN50wc	6405	295
2019-07-19 23:58	M0IJS	14.097174	-28	0	IO92ii	0.1	KD2OM	FN12gx	5528	291
2019-07-19 22:46	M0IJS	14.097158	-25	0	IO92ii	0.1	KD2OM	FN12gx	5528	291
2019-07-19 22:58	M0IJS	14.097131	-23	0	IO92ii	0.1	KD2OM	FN12gx	5528	291
2019-07-19 22:44	M0IJS	14.097064	-25	0	IO92ii	0.1	KD2OM	FN12gx	5528	291
2019-07-19 23:56	M0IJS	14.097040	-25	0	IO92ii	0.1	KD2OM	FN12gx	5528	291



Example Spots - 20200325

~28hrs running into
long wire antenna
with 9:1 un-un



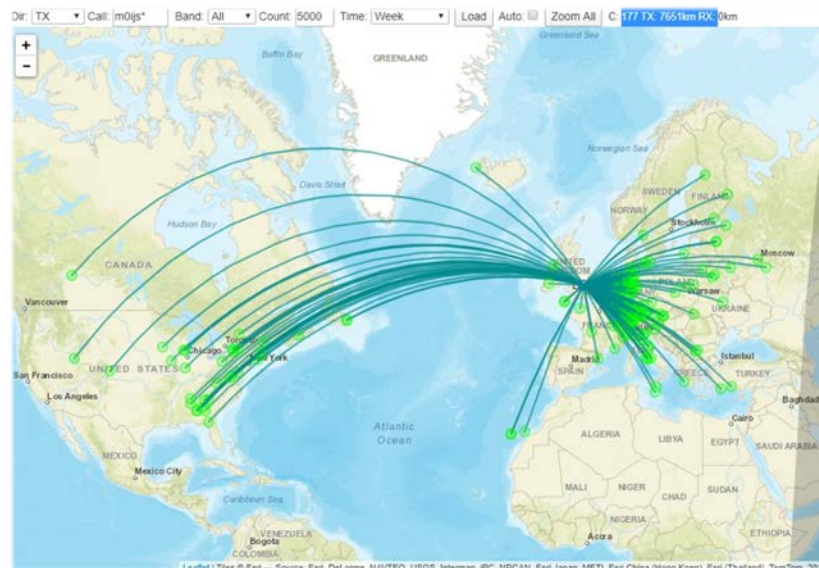
Best dx

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az	# Spots
2020-03-24 17:16	M0IJS	14.097061	-25	0	IO92	0.1	KA7OEI-1	DN31uo	7651	312	10
2020-03-24 17:16	M0IJS	14.097062	-24	0	IO92	0.1	W4HOD	EM72eo	6848	288	63
2020-03-25 13:02	M0IJS	14.097048	-27	0	IO92	0.1	K4IQJ	EM72gn	6841	287	6
2020-03-25 11:26	M0IJS	14.097143	-25	0	IO92	0.1	K4COD	EM73sc	6733	287	3
2020-03-24 18:24	M0IJS	14.097137	-25	0	IO92	0.1	N4GYN	EM84	6532	287	1
2020-03-25 15:48	M0IJS	14.097141	-24	0	IO92	0.1	N0UR	EN33	6446	301	3
2020-03-25 12:08	M0IJS	14.097078	-29	0	IO92	0.1	K9AN	EN50wc	6414	295	14
2020-03-24 18:36	M0IJS	14.097047	-27	0	IO92	0.1	KC8COM	EM97kj	6182	288	7
2020-03-25 11:12	M0IJS	14.097031	-26	0	IO92	0.1	K4RCG	FM08si	5938	288	14
2020-03-24 16:20	M0IJS	14.097045	-24	0	IO92	0.1	KD2OM	FN12gx	5538	291	73



Example Spots - 20200327

~76hrs running into
long wire antenna
with 9:1 un-un



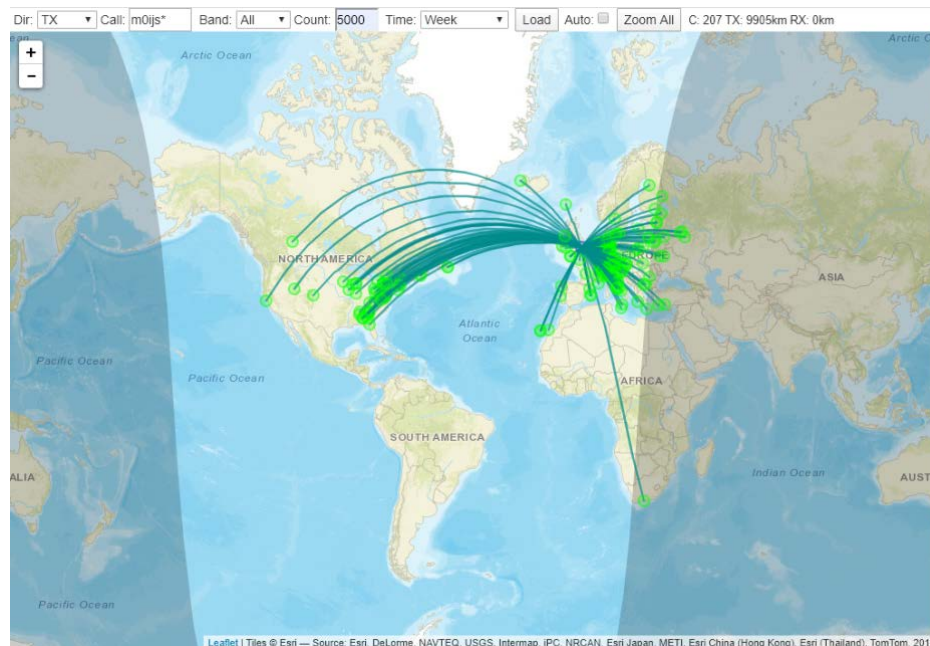
Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az	# Spots
2020-03-24 17:16	M0IJS	14.097061	-26	0	IO92	0.1	KA7OEI-1	DN31uo	7651	312	16
2020-03-27 15:00	M0IJS	14.097116	-27	0	IO92	0.1	WD0E	DM79qm	7425	305	1
2020-03-26 16:10	M0IJS	14.097029	-25	0	IO92	0.1	W4VS	EM80	6852	284	1
2020-03-24 12:16	M0IJS	14.097189	-24	0	IO92	0.1	W4HOD	EM72eo	6848	288	226
2020-03-24 13:38	M0IJS	14.097070	-26	0	IO92	0.1	K4IQJ	EM72gn	6841	287	36
2020-03-26 20:06	M0IJS	14.097069	-24	0	IO92	0.1	N4XWC	EM63nt	6831	289	5
2020-03-26 11:48	M0IJS	14.097121	-27	0	IO92	0.1	W3PM	EM64or	6753	290	1
2020-03-24 13:42	M0IJS	14.097064	-25	0	IO92	0.1	K4COD	EM73sc	6733	287	17
2020-03-25 21:06	M0IJS	14.097066	-26	0	IO92	0.1	WM4B	EM82em	6725	286	6
2020-03-26 15:48	M0IJS	14.097141	-22	-1	IO92	0.1	VE6JY	DO33or	6628	320	19

Best dx



Example Spots - 20200329

~124hrs running into
long wire antenna
with 9:1 un-un



Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az	# Spots
2020-03-29 13:20	M0IJS	14.097181	-26	0	IO92	0.1	ZS1LS	KF15nw	9905	160	1
2020-03-27 15:34	M0IJS	14.097174	-27	0	IO92	0.1	KPH	CM88mc	8489	317	1
2020-03-24 17:16	M0IJS	14.097061	-26	0	IO92	0.1	KA7OEI-1	DN31uo	7651	312	27
2020-03-27 15:00	M0IJS	14.097116	-27	0	IO92	0.1	WD0E	DM79qm	7425	305	1
2020-03-26 16:10	M0IJS	14.097029	-25	0	IO92	0.1	W4VS	EM80	6852	284	1
2020-03-24 12:16	M0IJS	14.097189	-24	0	IO92	0.1	W4HOD	EM72eo	6848	288	333
2020-03-24 13:38	M0IJS	14.097070	-25	0	IO92	0.1	K4IQJ	EM72gn	6841	287	53
2020-03-26 20:06	M0IJS	14.097069	-27	0	IO92	0.1	N4XWC	EM63nt	6831	289	14
2020-03-26 11:48	M0IJS	14.097121	-27	0	IO92	0.1	W3PM	EM64or	6753	290	1
2020-03-24 13:42	M0IJS	14.097064	-25	0	IO92	0.1	K4COD	EM73sc	6733	287	27

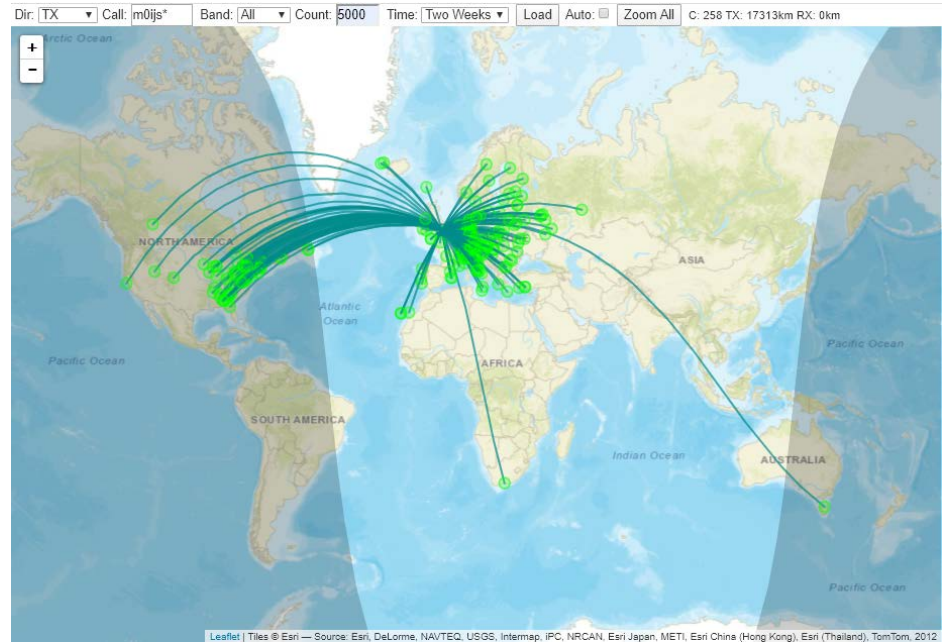
Best dx

South Africa!
KPH, San Francisco
Utah
Florida



Example Spots - 20200404

11days running into
long wire antenna
with 9:1 un-un



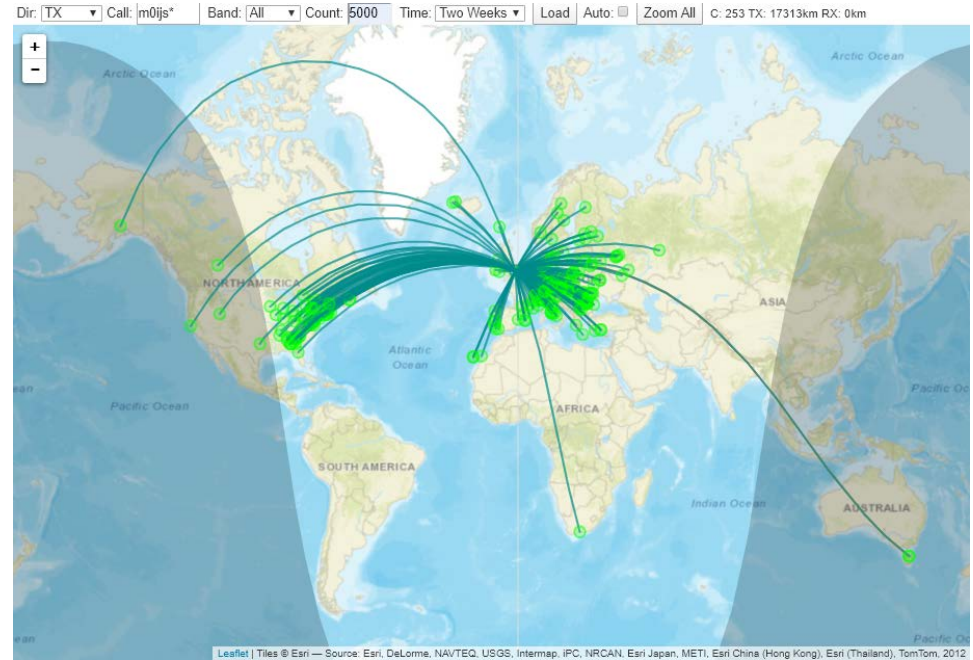
Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az	# Spots	
2020-04-03 20:48	M0IJS	14.097007	-30	0	IO92	0.1	VK7JJ/2	QE38lr	17313	75	2	Tasmania! (Exeter)
2020-03-29 13:20	M0IJS	14.097181	-26	0	IO92	0.1	ZS1LS	KF15nw	9905	160	1	South Africa (Cape Town)
2020-03-27 15:34	M0IJS	14.097174	-29	0	IO92	0.1	KPH	CM88mc	8489	317	2	KPH, San Francisco
2020-03-24 17:16	M0IJS	14.097061	-26	0	IO92	0.1	KA7OEI-1	DN31uo	7651	312	27	Utah
2020-03-27 15:00	M0IJS	14.097116	-27	0	IO92	0.1	WD0E	DM79qm	7425	305	1	Colorado
2020-04-01 14:52	M0IJS	14.097152	-23	0	IO92	0.1	W5KUB/HAB	EM55db	6910	292	8	Tennessee
2020-03-26 16:10	M0IJS	14.097029	-25	0	IO92	0.1	W4VS	EM80	6852	284	1	Georgia
2020-03-24 12:16	M0IJS	14.097189	-24	0	IO92	0.1	W4HOD	EM72eo	6848	288	453	Alabama
2020-03-24 13:38	M0IJS	14.097070	-26	0	IO92	0.1	K4IQJ	EM72gn	6841	287	69	Alabama
2020-04-03 21:44	M0IJS	14.097205	-26	0	IO92	0.1	K4JOP	EM72go	6838	287	1	Alabama

Best dx



Example Spots - 20200411

Past 14 days running
into long wire antenna
with 9:1 un-un



Best dx

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az	# Spots	
2020-04-03 20:48	M0IJS	14.097007	-30	0	IO92	0.1	VK7JJ/2	QE38lr	17313	75	2	Tasmania! (Exeter)
2020-04-08 16:32	M0IJS	7.040135	-28	0	IO92	0.1	VK7JJ	QE38lr	17313	75	5	
2020-03-29 13:20	M0IJS	14.097181	-26	0	IO92	0.1	ZS1LS	KF15nw	9905	160	1	South Africa (Cape Town)
2020-03-29 18:46	M0IJS	14.097201	-30	0	IO92	0.1	KPH	CM88mc	8489	317	1	KPH, San Francisco
2020-03-28 15:52	M0IJS	14.097075	-27	0	IO92	0.1	KA7OEI-1	DN31uo	7651	312	22	Utah
2020-04-05 22:14	M0IJS	14.097111	-24	0	IO92	0.1	K5XL	EM12kp	7569	295	2	Texas
2020-04-11 07:22	M0IJS	14.097168	-20	0	IO92	0.1	KL7L	BP51ip	7019	344	2	Alaska
2020-04-01 14:52	M0IJS	14.097152	-24	0	IO92	0.1	W5KUB/HAB	EM55db	6910	292	30	Tennessee
2020-04-05 22:26	M0IJS	14.097021	-29	0	IO92	0.1	WD4AH	EL89rt	6873	283	1	Florida
2020-03-28 12:02	M0IJS	14.097092	-24	0	IO92	0.1	W4HOD	EM72eo	6848	288	447	Alabama
2020-03-31 05:48	M0IJS	14.097129	+8	0	IO92	0.1	G8DLX	IO92ii	22	231	141	Mike G8DLX, Rugby.



2022

<https://github.com/threeme3/WsprryPi>

<https://github.com/JamesP6000/WsprryPi>

<https://github.com/IZ7BOJ/WsprryPi/releases/tag/pre-release>

<https://www.wsprnet.org/drupal/wsprnet/spots>

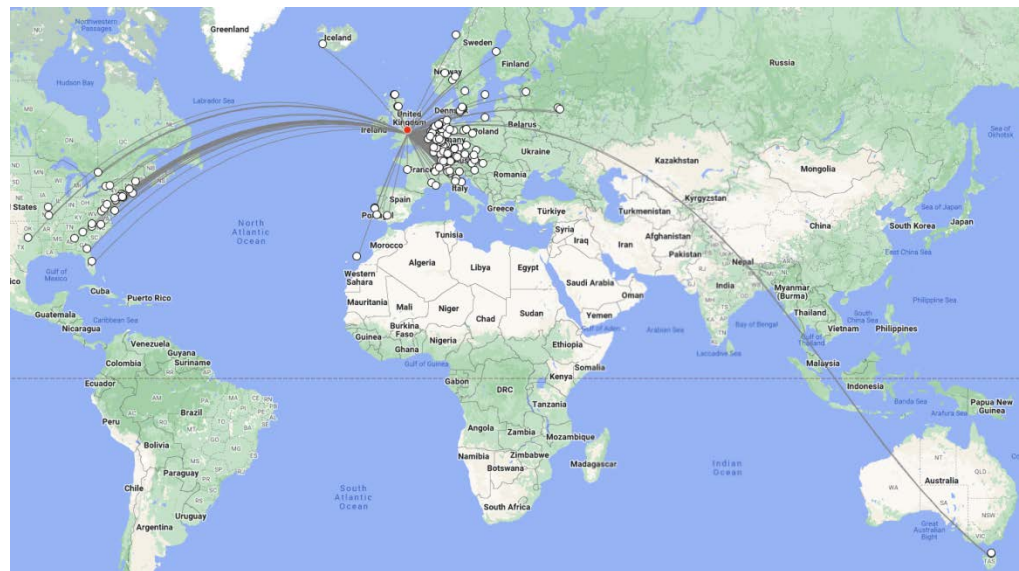
<https://wspr.rocks/>

Adding LPF switching via GPIO7..11



Example Spots - 20241027

13 hours running into
long wire antenna
with 9:1 un-un



Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az	Mode	# Spots	
2024-10-27 08:06	M0IJS	14.097178	-23	0	IO92	0.1	VK7JJ	QE38lr	17313	75	W-2	12	Tasmania! (Exeter)
2024-10-27 07:22	M0IJS	14.097166	-23	0	IO92	0.1	VK7EKA	QE38kv	17296	75	W-2	2	Tasmania! (Exeter)
2024-10-26 20:06	M0IJS	14.097052	-27	0	IO92	0.1	VK3TPM	QF22ds	16844	72	W-2	1	Victoria, Australia
2024-10-27 10:10	M0IJS	14.097173	-23	0	IO92	0.1	K5XL	EM12kp	7569	295	W-2	4	Texas, USA
2024-10-27 07:44	M0IJS	14.097164	-15	0	IO92	0.1	KN1R	EL97	6964	280	W-2	2	Florida, USA
2024-10-27 10:08	M0IJS	14.097167	-22	0	IO92	0.1	K6RFT	EM47bg	6867	295	W-2	11	Missouri, USA
2024-10-27 10:10	M0IJS	14.097174	-20	0	IO92	0.1	K4IQJ	EM72gn	6841	287	W-2	14	Kentucky, USA
2024-10-27 08:58	M0IJS	14.097177	-25	0	IO92	0.1	KC9VNU	EM80ug	6819	283	W-2	7	Florida, USA
2024-10-27 08:52	M0IJS	14.097090	-23	0	IO92	0.1	AC0G/B2	EM38ww	6749	297	W-2	3	Missouri, USA
2024-10-27 08:02	M0IJS	14.097167	-21	0	IO92	0.1	KX4AZ/A	EM83hw	6596	287	W-2	3	Georgia, USA



Best dx

