

# WSPR

## An Introduction and My Experience

*Sam Howard, KV4XY*

*Presentation to the Tellico Lake ARC*

*March 18, 2020*

# Thanks to:

- K1JT, Joe Taylor
- KP4MD, Carol Milazzo
- KB9AMG, Mark Diedrich

# Joe Taylor, K1JT



Nobel Prize in Physics Laureate

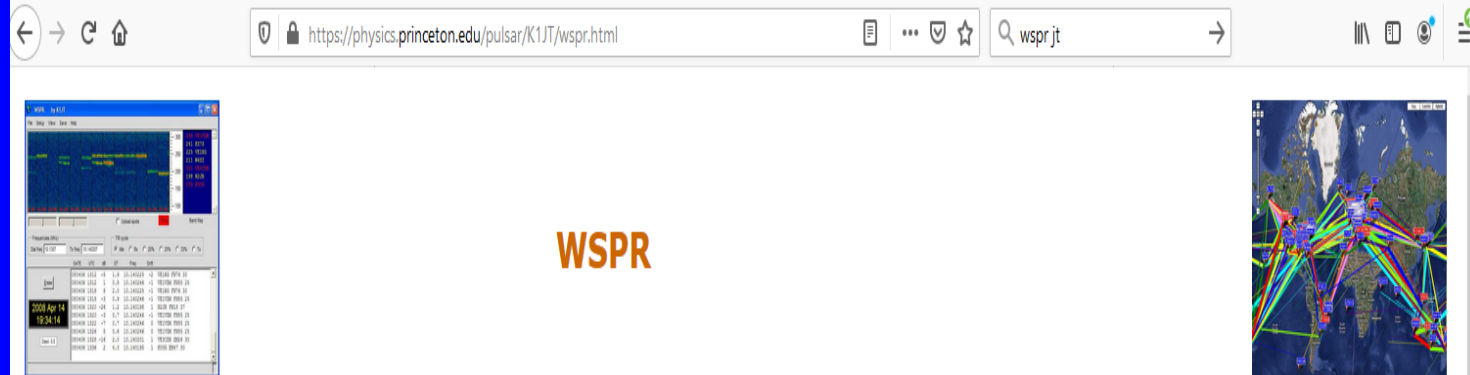
Physics, Astronomy, Applied Mathematics

Author of the WSJT software package

for long distance low power

weak signal communications

(includes WSPR, JT65, and other modes)



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[WSJT-X](#)  
[WSJT](#)  
[MAP65](#)  
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[SimJT](#)  
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## Description

WSPR implements a protocol designed for probing potential propagation paths with low-power transmissions. Normal transmissions carry a station's callsign, Maidenhead grid locator, and transmitter power in dBm. The program can decode signals with S/N as low as -28 dB in a 2500 Hz bandwidth. Stations with internet access can automatically upload their reception reports to a central database called [WSPRnet](#), which includes a mapping facility. To see a live version of the map pictured at top right, click [here](#).

**WSJT-X** now includes WSPR among its many supported modes. Most operators will be best served by using **WSJT-X** for WSPR as well as for any of the two-way communication modes.

**WSPR 2** is showing its age but is still perfectly usable. It may be especially desirable if you need a lightweight program that runs on older computers. It features a user-friendly setup screen with drop-down selection of audio devices and rig-control parameters, support for compound callsigns, fine selection of the fractional time for transmitting, and a *Tune* button. A new *Advanced* setup screen offers optional CW identification and tools for frequency calibration and automated frequency corrections for your radio. Full details are presented in the [WSPR 2.0 User's Guide](#). Binary installation package is made available for Ubuntu Linux (versions 8.10 and later), Debian 5.03, and other Debian-based 32-bit Linux distributions.

**WSPR 2.11** and **WSPR 2.12** include these enhancements over WSPR 2.0:

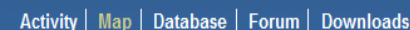
- Support for software-defined receivers and transceivers that use complex (I/Q) sampling, such as the popular SoftRock kits.
- **FMT**, a package of command-line programs designed for use in the ARRL Frequency Measuring Test and similar frequency-measuring tasks.

## Downloads

- Windows: [WSPR 2.0](#) [WSPR 2.12 and FMT](#)
- Linux (.deb file): [WSPR 2.0](#) [WSPR 2.11 and FMT](#)

## Documentation

- [WSPR 2.1: Supplement to User's Guide \(English\)](#)
- [WSPR 2.1: Supplement to User's Guide \(Italian, IK1UWL\)](#)
- [WSPR 2.1: Supplement to User's Guide \(Spanish, EA2SN\)](#)



## Log in

USB dial (MHz): 0.136, 0.4742,  
1.8366, 3.5686, 5.2872, 5364.7,  
7.0386, 10.1387, 14.0956,  
18.1046, 21.0946, 24.9246,  
28.1246, 50.293, 70.091,  
144.489, 432.300, 1296.500

► [Forums](#)

[M0XDK Map](#)  
[KB9AMG Monthly Stats](#)  
[WA2ZKD Spot Analysis](#)

- WA2ZKD
- vk2kcm
- AB1YX
- n2mn
- PD0QHW

## KB9AMG's Top WSPR Spots

[2-way WSPR Reports](#) - March 2020

[WSPR Spots Stats](#) - March 2020

[WSPR Grids](#) - [Archive](#)

[TX Summaries](#) - [RX Summaries](#)

Band Reports - [Maximum km](#) - [Unique](#)

Top km/Watt - [LF](#) [MF](#) [160m](#) [80m](#) [60m](#) [40m](#) [30m](#) [20m](#)

Top km/Watt - [17m](#) [15m](#) [12m](#) [10m](#) [6m](#) [4m](#) [2m](#) [70cm](#) [23cm](#)

Propagation - [LF](#) [MF](#) [160m](#) [80m](#) [60m](#) [40m](#) [30m](#) [20m](#)

Propagation - [17m](#) [15m](#) [12m](#) [10m](#) [6m](#) [4m](#) [2m](#) [70cm](#) [23cm](#)

2-way WSPR Reports - [1](#) - [February 2020](#) - [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#) [12](#)

WSPR Spots Stats - [February 2020](#)

Top WSPR Spots - [February 2020](#)

Top WSPR Spotters - [February 2020](#)

WSPRnet Home - [wsprnet.org](#)

WSPR Challenge - [wspr.pelitr.com](#)

M0XDK Real-time WSPR Map - [wspr.aprsinfo.com](#)

VK7JJ Real-time WSPR Map and Charts - [wspr.vk7jj.com](#)

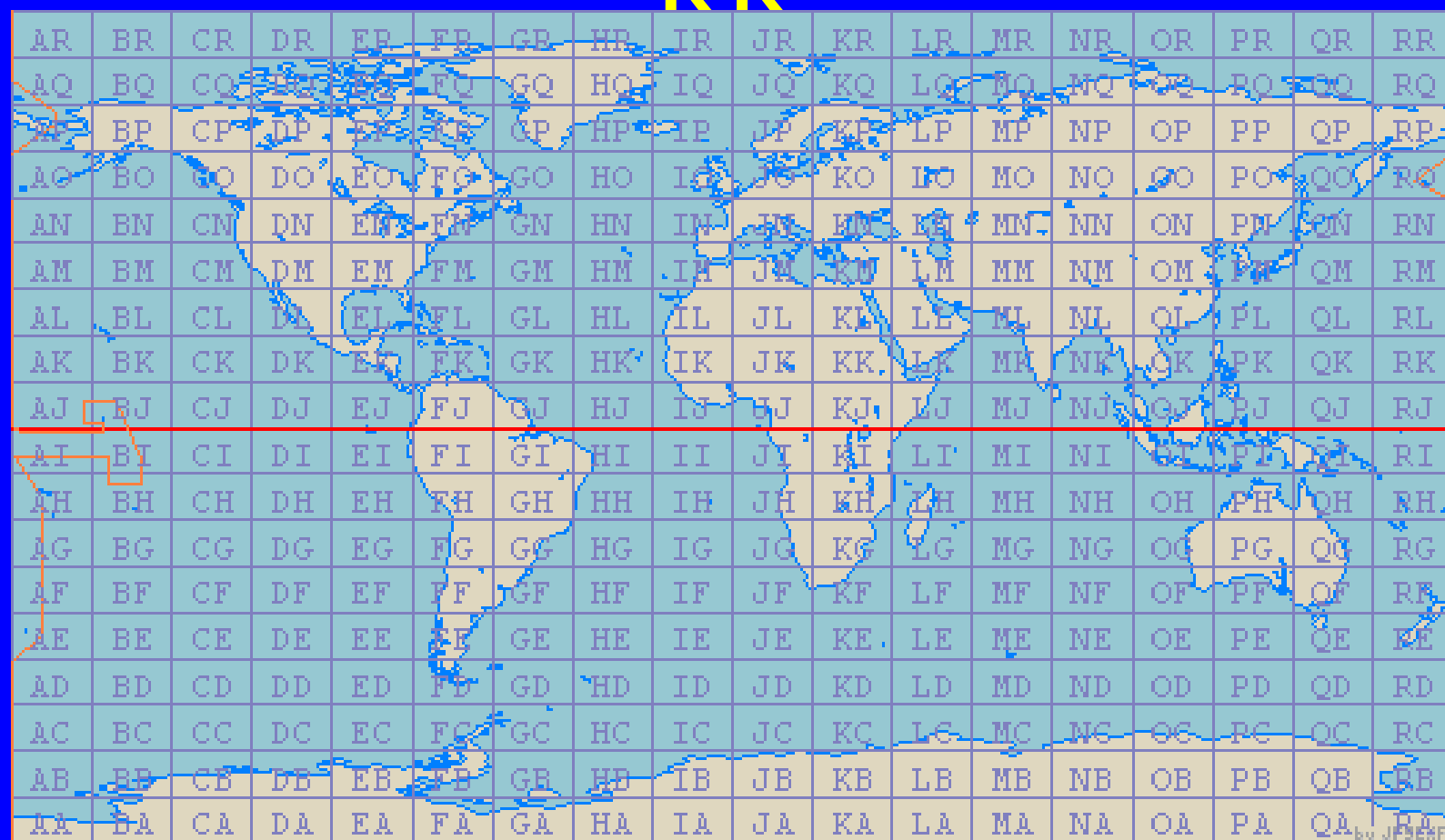
WA2ZKD Real-time WSPR Spot Analysis - [www.wa2zkd.net:8088](#)

# WSPR Purpose

Purpose – to probe potential  
radio propagation paths using  
low-power beacon-like transmissions.

Transmission format – call sign  
+ grid square + power level (dBm)  
e.g. “KP4MD CM98 37”

# Maidenhead Locator Fields AA-RR



AR	BR	CR	DR	ER	FR	GR	HR	IR	JR	KR	LR	MR	NR	OR	PR	QR	RR
AQ	BQ	CQ	DQ	EQ	FQ	GQ	HQ	IQ	JQ	KQ	LQ	MQ	NQ	OQ	PQ	QQ	RQ
AP	BP	CP	DP	EP	FP	GP	HP	IP	JP	KP	LP	MP	NP	OP	PP	QP	RP
AO	BO	CO	DO	EO	FO	GO	HO	IO	JO	KO	LO	MO	NO	OO	PO	QO	RO
AN	BN	CN	DN	EN	FN	GN	HN	IN	JN	KN	LN	MN	NN	ON	PN	QN	RN
AM	BM	CM	DM	EM	FM	GM	HM	IM	JM	KM	LM	MM	NM	OM	PM	QM	RM
AL	BL	CL	DL	EL	FL	GL	HL	IL	JL	KL	LL	ML	NL	OL	PL	QL	RL
AK	BK	CK	DK	EK	FK	GK	HK	IK	JK	KK	LK	MK	NK	OK	PK	QK	RK
AJ	BJ	CJ	DJ	EJ	FJ	GJ	HJ	IJ	JJ	KJ	LJ	MJ	NJ	OJ	PJ	QJ	RJ
AI	BI	CI	DI	EI	FI	GI	HI	II	JI	KI	LI	MI	NI	OI	PI	QI	RI
AH	BH	CH	DH	EH	FH	GH	HH	IH	JH	KH	LH	MH	NH	OH	PH	QH	RH
AG	BG	CG	DG	EG	FG	GG	HG	IG	JG	KG	LG	MG	NG	OG	PG	QG	RG
AF	BF	CF	DF	EF	FF	GF	HF	IF	JF	KF	LF	MF	NF	OF	PF	QF	RF
AE	BE	CE	DE	EE	FE	GE	HE	IE	JE	KE	LE	ME	NE	OE	PE	QE	RE
AD	BD	CD	DD	ED	FD	GD	HD	ID	JD	KD	LD	MD	ND	OD	PD	QD	RD
AC	BC	CC	DC	EC	FC	GC	HC	IC	JC	KC	LC	MC	NC	OC	PC	QC	RC
AB	BB	CB	DB	EB	FB	GB	HB	IB	JB	KB	LB	MB	NB	OB	PB	QB	RB
AA	BA	CA	DA	EA	FA	GA	HA	IA	JA	KA	LA	MA	NA	OA	PA	QA	RA



# dBm to Watts equivalents

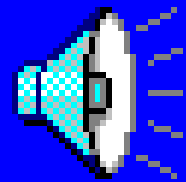
dBm	W	mW
0	0.001	1
10	0.01	10
20	0.1	100
30	1	1,000
40	10	10,000
50	100	100,000

# WSPR Mode

Modulation - compressed data format  
with strong forward error correction  
and narrow-band 4-FSK modulation.  
(6 Hz bandwidth)

The protocol is effective at  
signal-to-noise ratios as low as  
−28 dB in a 2500 Hz bandwidth.

**WSPR**



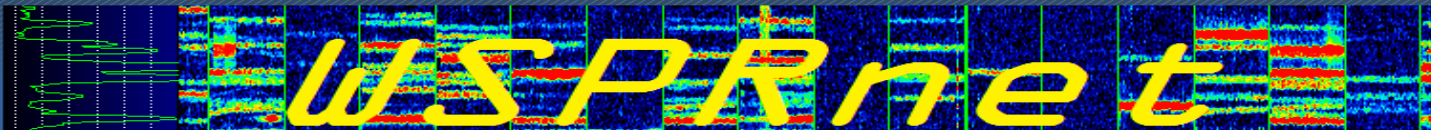
# Relative sensitivity of modes

Mode	S/N Required	Power example
WSPR	-27dB	5W
Olivia	-17dB	50W
PSK31	-7dB	500W
RTTY	+5dB	8,000W
SSB	+10dB	25,000W

# WSPR

Receiving stations  
with internet access automatically  
upload reception reports to  
a central database at  
<http://wsprnet.org>

# http://wsprnet.org/drupal/wsprnet /spot



**WSPR**  
Welcome to

### User login

Username \*

Password \*

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

### Spot Database

Specify query parameters

200 spots:

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2020-03-18 19:28	KV4XY	14.097046	-17	0	EM75vu	5	KPH	CM88mc	3426	286
2020-03-18 19:28	KV4XY	14.097044	0	0	EM75vu	5	WD0E	DM79qm	1838	289
2020-03-18 19:28	KV4XY	14.097047	-23	0	EM75vu	5	ND7M	DM16xf	2849	280
2020-03-18 19:28	KV4XY	14.097046	-26	0	EM75vu	5	IZ6198SWL	JN61vq	8031	51
2020-03-18 19:28	KV4XY	14.097075	-10	-1	EM75vu	5	N1ZPY	FN64cq	1699	50
2020-03-18 19:28	KV4XY	14.097047	-10	0	EM75vu	5	N6GN/K	DN70II	1887	292
2020-03-18 19:28	KV4XY	14.097048	-27	0	EM75vu	5	DJ9PC	JN59po	7415	45
2020-03-18 19:28	KV4XY	14.097046	-16	0	EM75vu	5	KK6PR	CN94ik	3262	299
2020-03-18 18:42	KV4XY	7.040048	-24	0	EM75vu	5	N8TWX	EN82bw	788	2
2020-03-18 18:42	KV4XY	7.040080	-9	0	EM75vu	5	K4JOP	EM72go	379	198
2020-03-18 18:42	KV4XY	7.040039	-6	0	EM75vu	5	AD0MO	EM48	672	298
2020-03-18 18:42	KV4XY	7.040037	-16	0	EM75vu	5	WA2ZKD	FN13ed	987	33
2020-03-18 18:42	KV4XY	7.040036	-22	0	EM75vu	5	K2JY	EM40	872	229
2020-03-18 18:42	KV4XY	7.040060	-18	0	EM75vu	5	K5CZD	EM32vn	821	246
2020-03-18 18:42	KV4XY	7.040021	-27	0	EM75vu	5	WB1BQE	FN42ht	1345	51
2020-03-18 18:42	KV4XY	7.040035	-19	0	EM75vu	5	KG5ZDA	EM12qw	1184	258
2020-03-18 18:42	KV4XY	7.040036	-20	0	EM75vu	5	KH6RD	EM71di	519	196
2020-03-18 18:42	KV4XY	7.040062	-4	0	EM75vu	5	WS3W	FM19ng	749	57
2020-03-18 18:42	KV4XY	7.040036	-17	0	EM75vu	5	W5TSU	EM15em	1211	272
2020-03-18 18:42	KV4XY	7.040044	-22	0	EM75vu	5	W2GNN	FN20qh	973	57
2020-03-18 18:42	KV4XY	7.040045	-26	0	EM75vu	5	WM1N	FN41sp	1353	57
2020-03-18 18:42	KV4XY	7.040022	-17	0	EM75vu	5	KC8JNV	EN11vd	1197	303
2020-03-18 18:42	KV4XY	7.040035	-12	0	EM75vu	5	WO2S	FM05pv	496	88
2020-03-18 18:42	KV4XY	7.040048	-17	0	EM75vu	5	N4TVC	FM18is	692	60
2020-03-18 18:42	KV4XY	7.040035	-1	0	EM75vu	5	N8AUM	EM70em	607	193
2020-03-18 18:42	KV4XY	7.040130	-26	0	EM75vu	5	KD2LZI	FN22vt	1155	45
2020-03-18 18:42	KV4XY	7.040032	-16	0	EM75vu	5	K3KQV	FN00	684	40
2020-03-18 18:42	KV4XY	7.040037	-22	0	EM75vu	5	N4JJS	FM05on	490	92

### Frequencies

USB dial (MHz): 0.136, 0.4742, 1.8366, 3.5686, 5.2872, 5364.7, 7.0386, 10.1387, 14.0956, 18.1046, 21.0946, 24.9246, 28.1246, 50.293, 70.091, 144.489, 432.300, 1296.500

### Navigation

► [Forums](#)

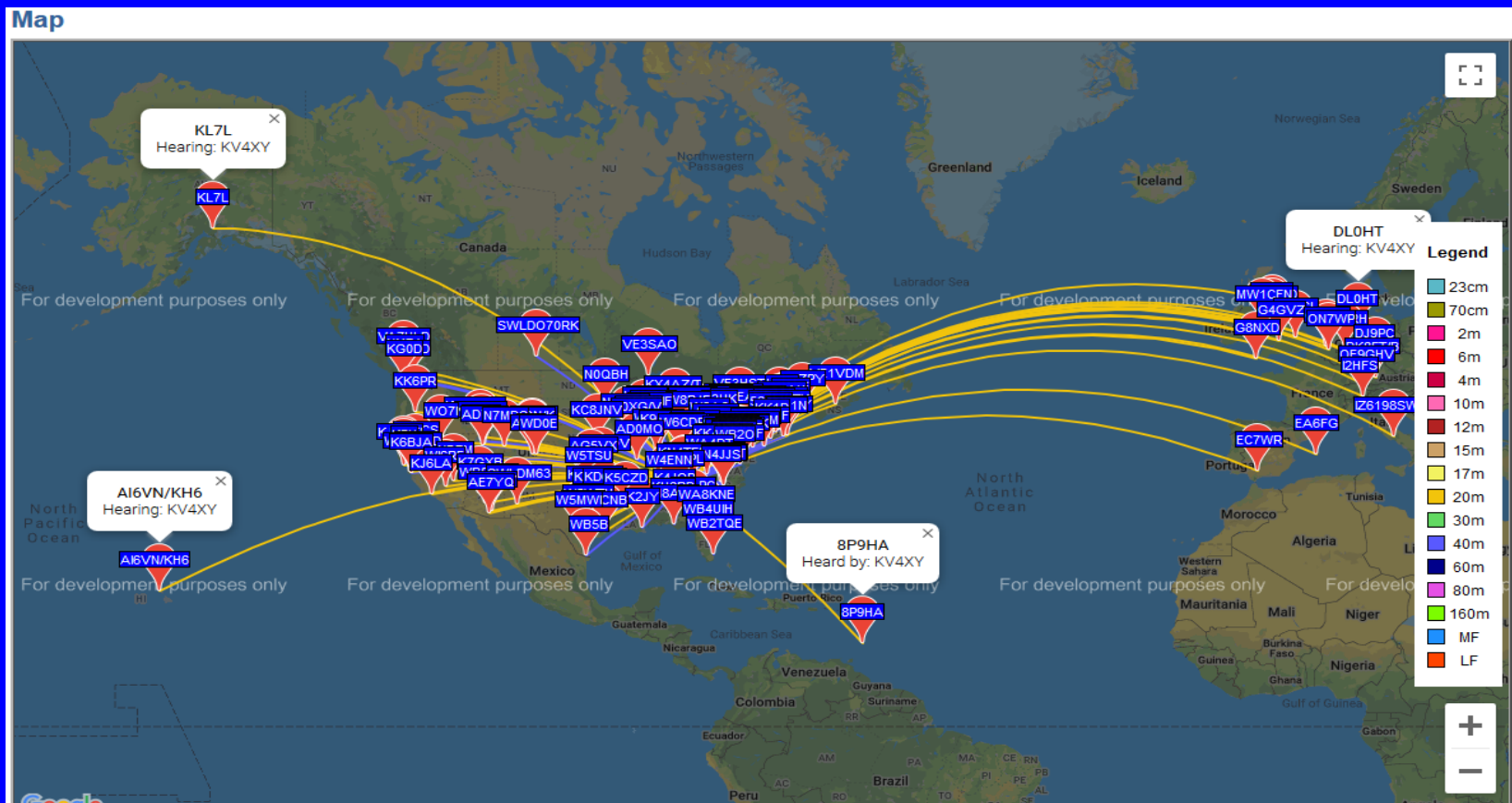
### 3rd Party Maps and Data

[M0XDK Map](#)  
[KB9AMG Monthly Stats](#)  
[WA2ZKD Spot Analysis](#)

### Who's online

There are currently 87 users online.

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



# WSPR Frequencies

The default USB dial frequencies (MHz):

0.136\*, 0.4742\*, 1.8366, 3.5926, 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

200 Hz segment in each band

\*frequencies not authorized in U.S.

# WSPR – Station requirements

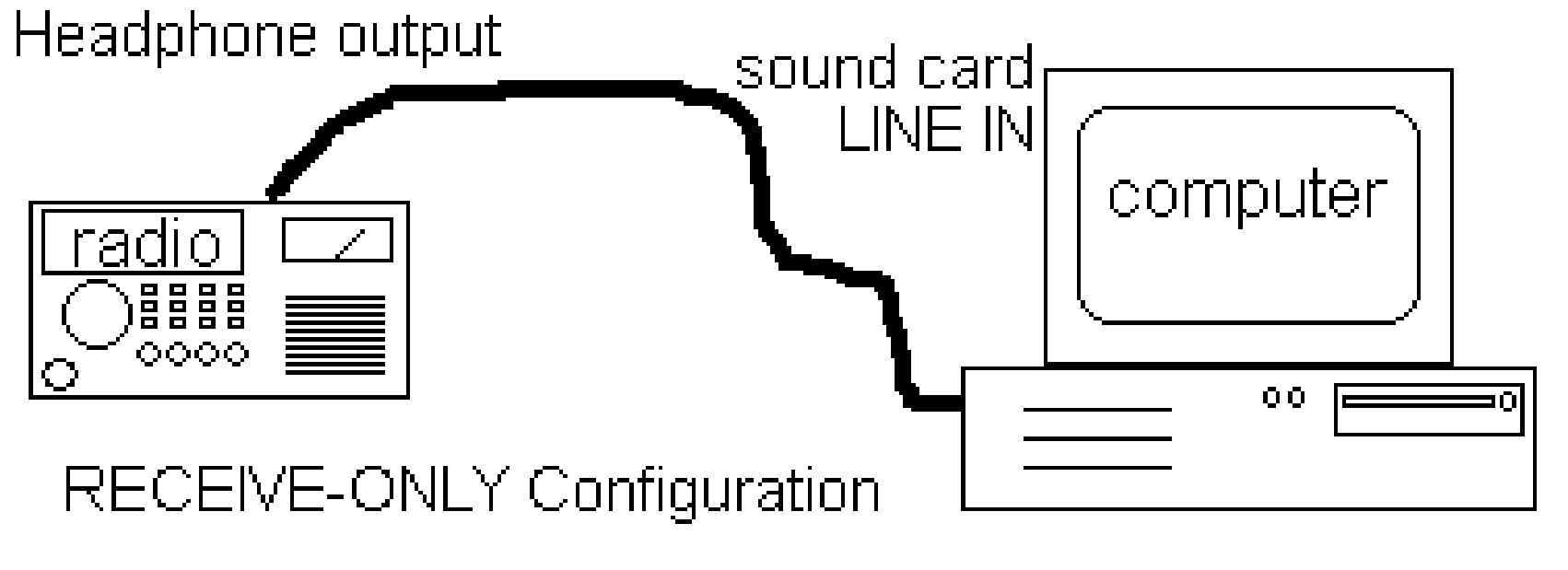
- SSB receiver or transceiver and antenna
- Computer running the Windows, Linux, FreeBSD, or OS X operating system.
- 1.5 GHz or faster CPU and at least 100 MB of available RAM
- Monitor with at least 800 x 600 resolution
- Sound card supported by your operating system and capable of 48 kHz sample rate



# WSPR – Station requirements

- If you will transmit as well as receive, an interface using a serial port to key your PTT line or a serial cable for CAT control. Alternatively, you can use VOX control.
- Audio connection(s) between receiver/transceiver and sound card
- A means for synchronizing your computer clock to UTC

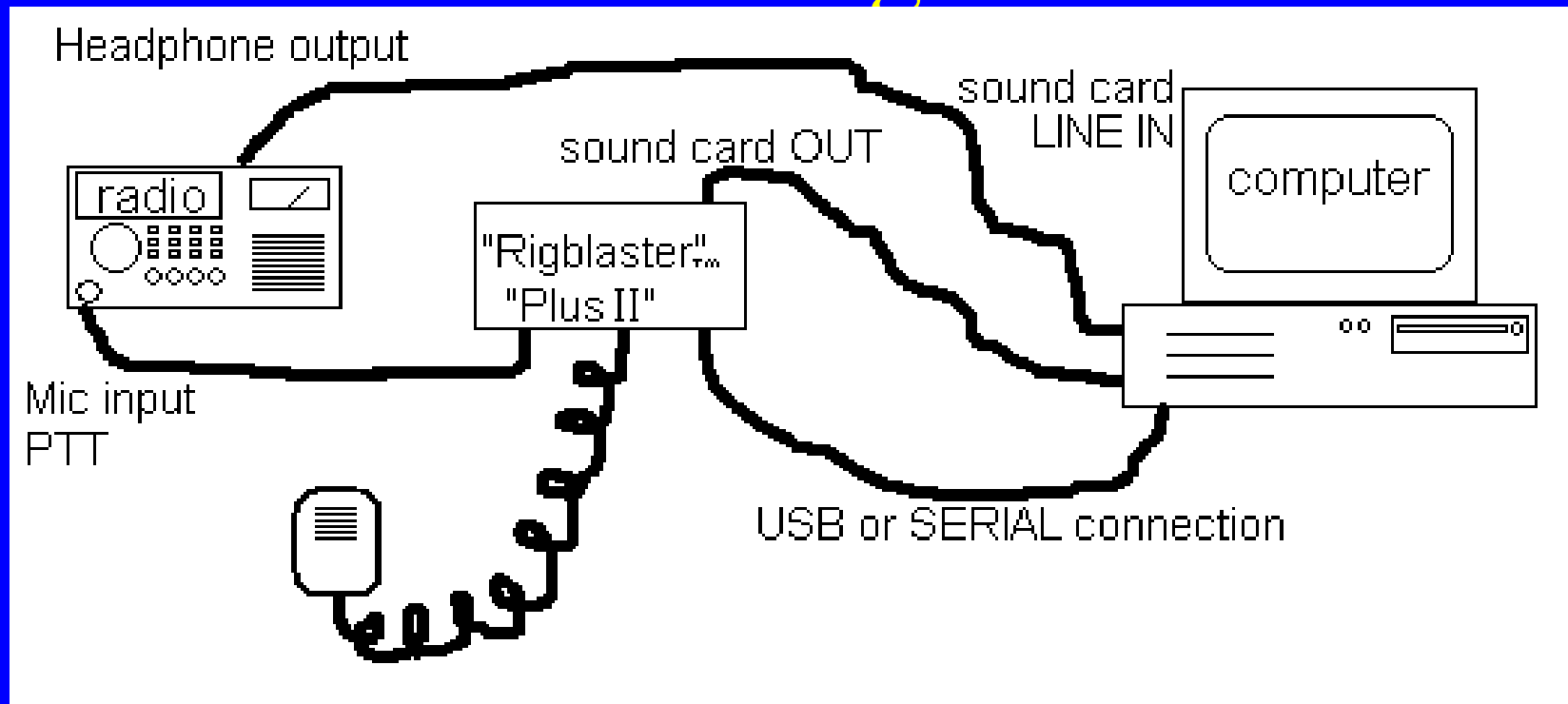
# Sound Card Digital Modes



***Receive only configuration***

Diagram courtesy [West Mountain Radio](#)

# Sound Card Digital Modes



***This basic configuration is the same for all sound card digital modes – PSK31, WSPR, JT63, etc.***

Diagram courtesy [West Mountain Radio](#)

# Rigblaster Soundcard Interface



Photo courtesy [West Mountain Radio](#)

# Signalink Soundcard Interface



# Ultimate3S kit

## Details

- Created: 12 May 2015
- Last Updated: 30 October 2018
- Hits: 222751



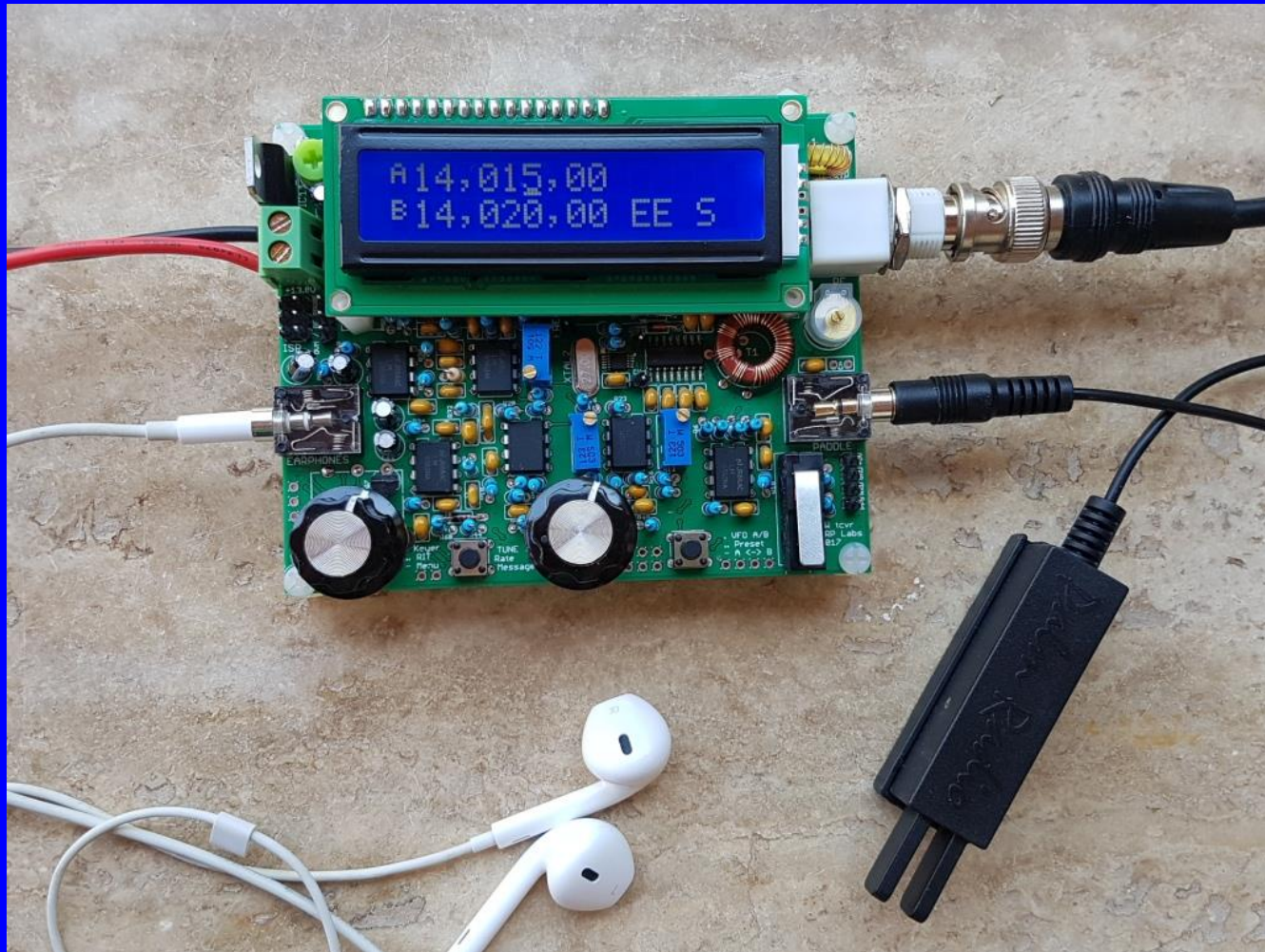
The Ultimate3S QRSS/WSPR Transmitter Kit is the new edition of the third version in the "Ultimate" QRSS/WSPR kit trilogy. It can produce QRSS, Hell, WSPR, Opera and PI4 slow-signal modes anywhere from 2200m to 2m and even 222MHz bands. Plug-in LPF filters are available for all 16 HF/MF/LF/VHF bands from 2200m to 222MHz.

Click!  
Shop order  
from  
**\$33**

The U3S kit was launched in January 2015. It is the new edition of the [earlier U3 kit](#) produced from November 2013 to December 2014. The U3S uses an [Si5351A frequency synthesiser kit](#) rather than the pre-built AD9850 DDS kit used in the [earlier U3 kit](#). The AD9850 DDS kit prices are rising and they are becoming less easily available. The [Si5351A frequency synthesiser kit](#) was developed to ensure continued low cost of the Ultimate QRSS/WSPR kit series.

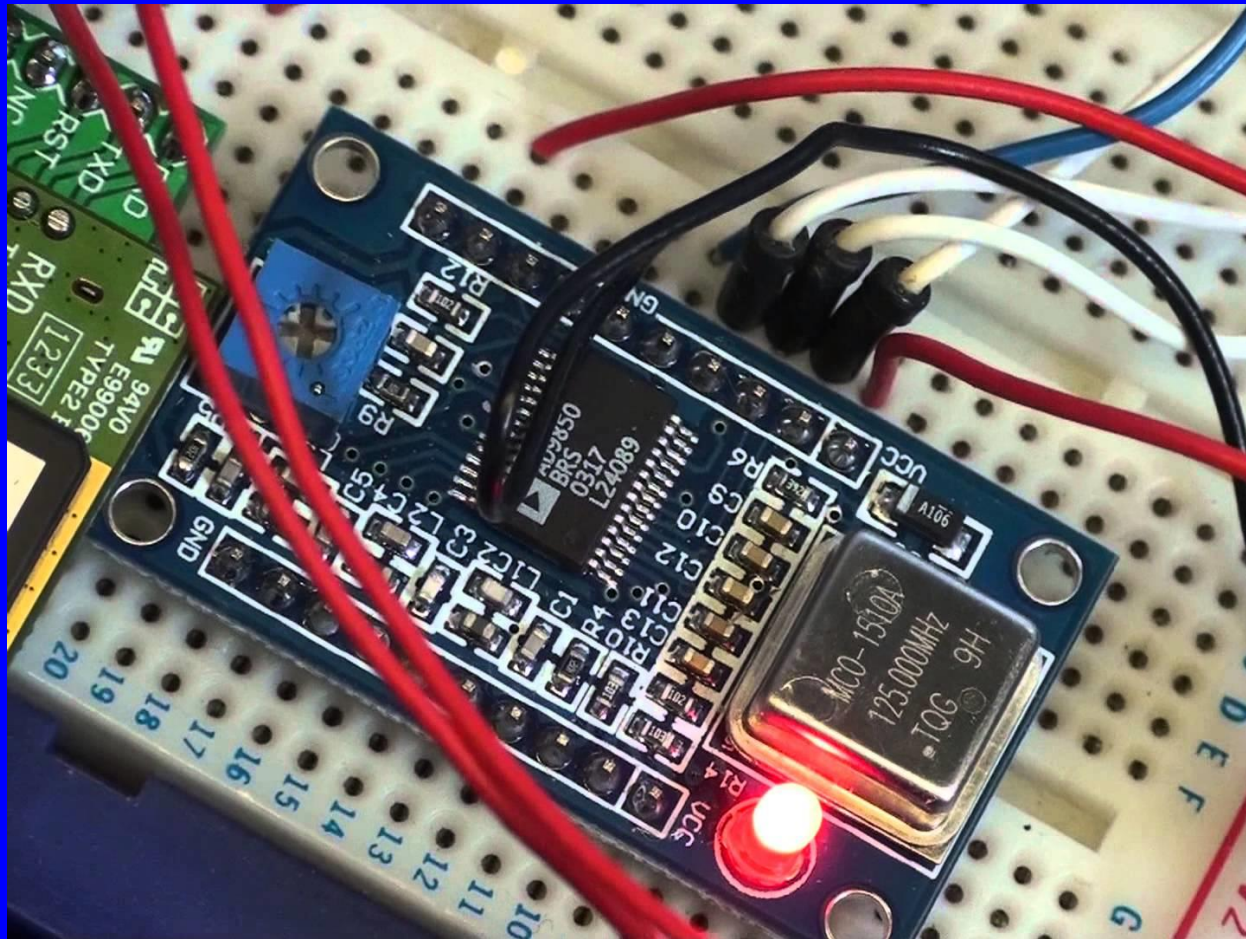
Please also see the original version [Ultimate QRSS kit](#) and [Ultimate2 QRSS kit](#) pages, and the [earlier U3 kit](#) page to appreciate the heritage. Much of the information in these earlier pages is still relevant and informative.

# QRP Labs QCX 5W Transceiver



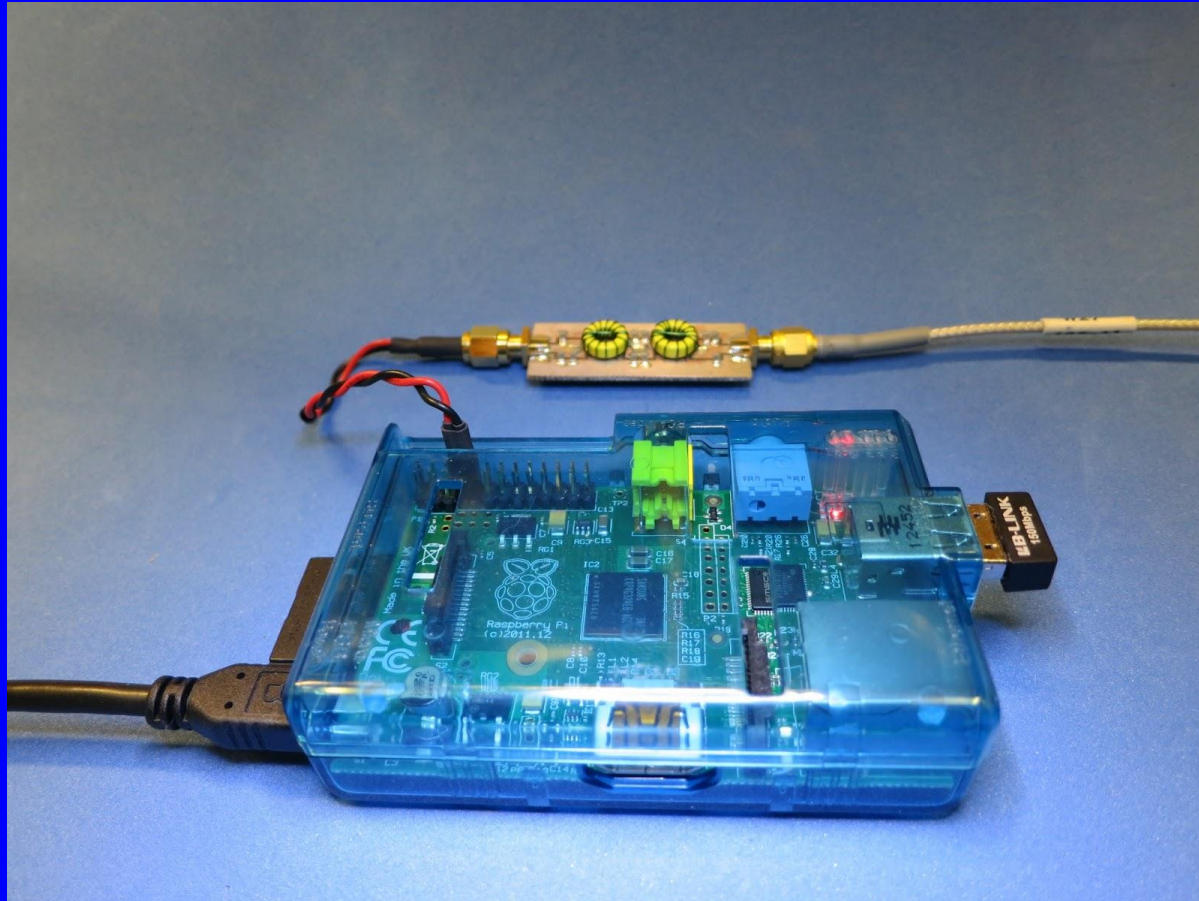


# WSPR Arduino





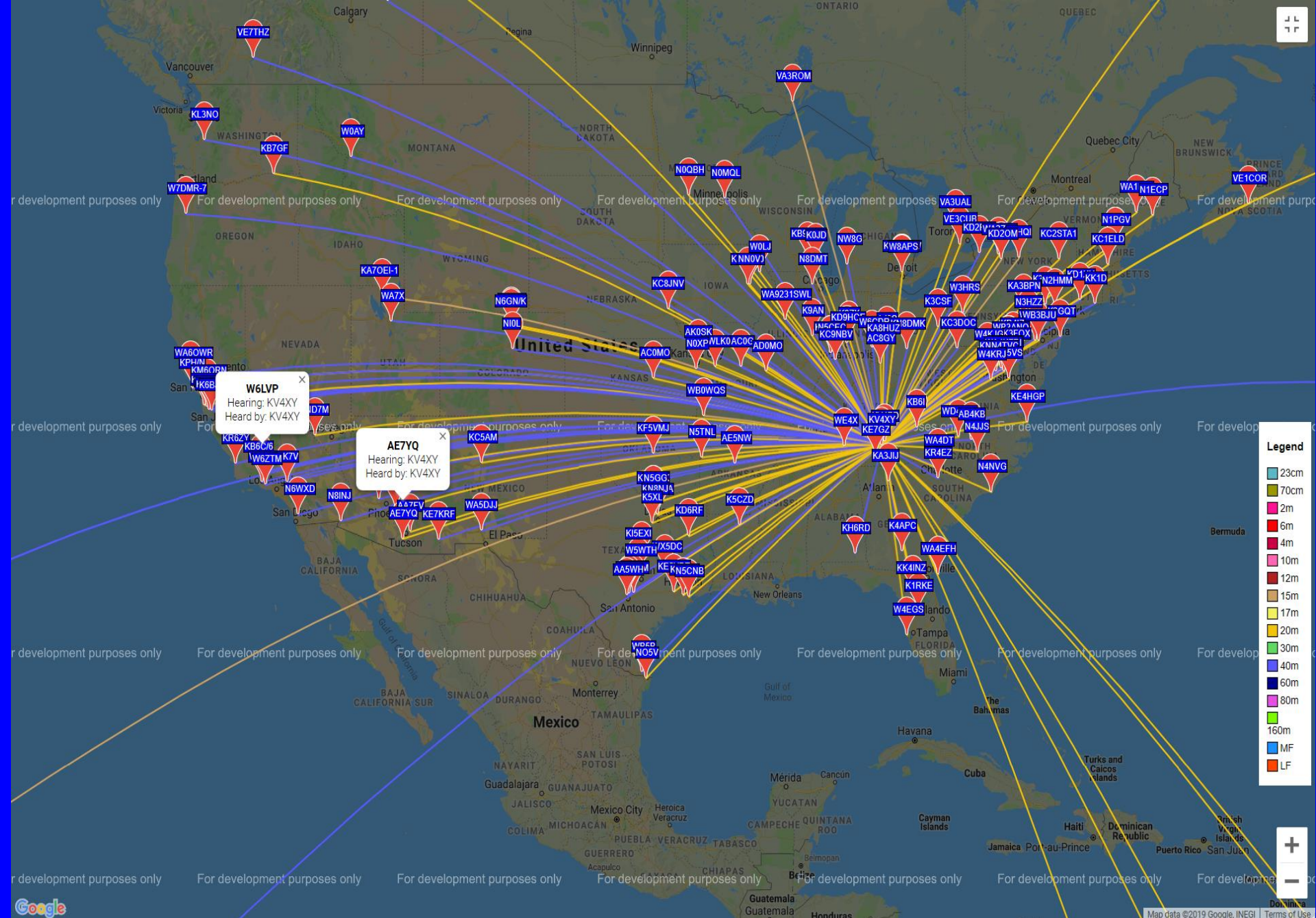
# WSPR Raspberry Pi



[http://mardie4.100webspaces.net/2\\_way\\_wspr\\_reports/KV4XY-EM75.html](http://mardie4.100webspaces.net/2_way_wspr_reports/KV4XY-EM75.html)

## KV4XY-EM75

Band	Reports	Rank
<u>LF/VLF</u>	-	-
<u>160m</u>	-	-
<u>80m</u>	-	-
<u>60m</u>	-	-
<u>40m</u>	225	46
<u>30m</u>	26	172
<u>20m</u>	126	50
<u>17m</u>	-	-
<u>15m</u>	-	-
<u>12m</u>	-	-
<u>10m</u>	-	-
<u>6m</u>	-	-
<u>4m</u>	-	-
<u>2m</u>	-	-
<u>70cm</u>	-	-
<u>23cm</u>	-	-
-----		
Total =	377	Reports - (Rank 61)
Number of Grid Squares = 158		



W6LVP  
Hearing: KV4XY  
Heard by: KV4XY

AE7YQ  
Hearing: KV4XY  
Heard by: KV4XY

- Legend
- 23cm
  - 70cm
  - 2m
  - 6m
  - 4m
  - 10m
  - 12m
  - 15m
  - 17m
  - 20m
  - 30m
  - 40m
  - 60m
  - 80m
  - 160m
  - MF
  - LF



## KB9AMG - WSPR Grids - EM - EM75

EM75 Map

### Top WSPR Spotters - EM75 - MAR 1-17 2020

Spots	Calls	Reporter-Grid
28335	3074	<a href="#">KV4XY-EM75vu</a> (Mar 1-17)
9733	798	<a href="#">W4JRZ-EM75jd</a> (Mar 1, 4-5, 7-11)
6183	272	<a href="#">KW4KD-EM75jc</a> (Mar 3-5)
609	112	<a href="#">W4PGM-EM75vu</a> (Mar 12)
2270	86	<a href="#">KU4XR-EM75xr</a> (Mar 1-2, 5-9, 11-12, 16-17)
162	43	<a href="#">WK9M-EM75us</a> (Mar 1)
45	37	<a href="#">WA4MXF-EM75ux</a> (Mar 1)
27	25	<a href="#">KN4TFR-EM75ww</a> (Mar 5, 15)
207	16	<a href="#">KU4XR/15-EM75xr</a> (Mar 1-2, 5-9, 16)
30	4	<a href="#">KU4XR-15-EM75xr</a> (Mar 16-17)

### Top WSPR Spotters - EM75 - FEB 1-29 2020

Spots	Calls	Reporter-Grid
31242	4138	<a href="#">KV4XY-EM75vu</a> (Feb 1-29)
1561	187	<a href="#">W4JRZ-EM75jd</a> (Feb 2-4, 29)
5861	133	<a href="#">KU4XR-EM75xr</a> (Feb 1, 3-6, 10-16, 20-21, 23, 27-28)
353	109	<a href="#">WK9M-EM75us</a> (Feb 1-2)
77	33	<a href="#">WA4GLH-EM75jd</a> (Feb 8, 11)
25	21	<a href="#">KK4DBN-EM75wo</a> (Feb 10)
20	17	<a href="#">KN4TFR-EM75ww</a> (Feb 1)
25	16	<a href="#">AC6ZM-EM75ur</a> (Feb 2)
11	1	<a href="#">KU4XR/15-EM75xr</a> (Feb 27)



