WSPR Mode – Weak Signal Propagation Reporter

Easiest Entry (?) into Digital Modes

Baby Steps!

3/25/17 HARC,
update 5/11/17 FWARC
W7KVI, N7EP, K7GJM, et al

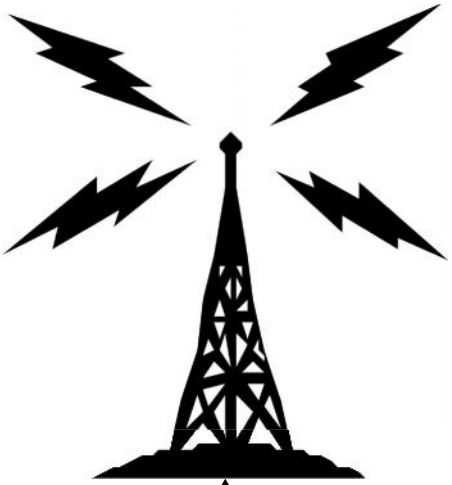
What's Needed?

- PC, WSPR Software (free)
- Interface, Rig-to-PC
- Rig (HF, V/U, any band, low power (5 w typical))
- Antenna (nearly any)
- Time sync software (free)

Audio, Ctrl

Interface

RF

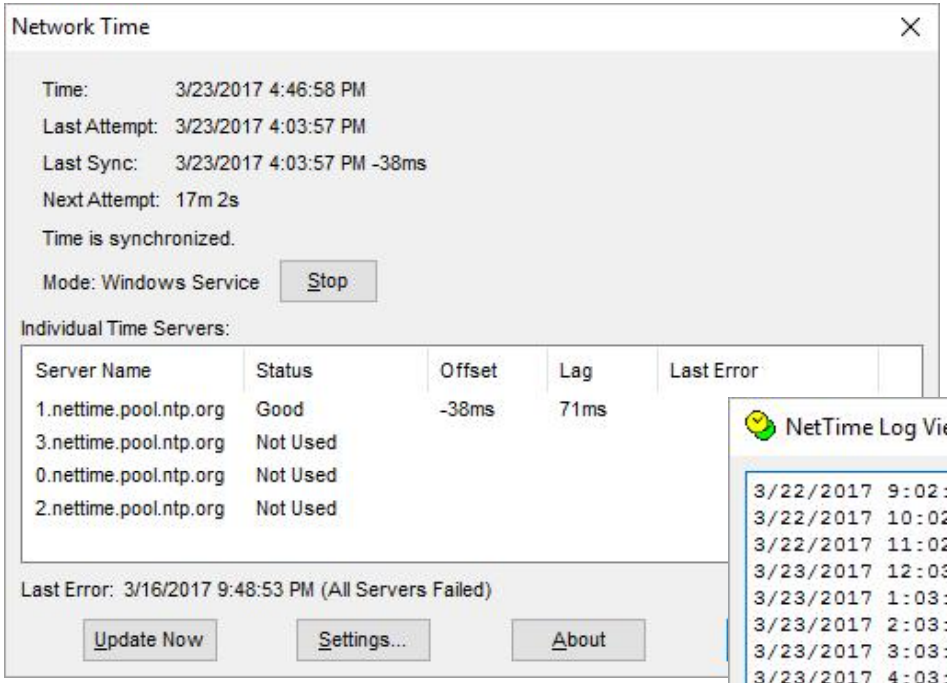


Rig

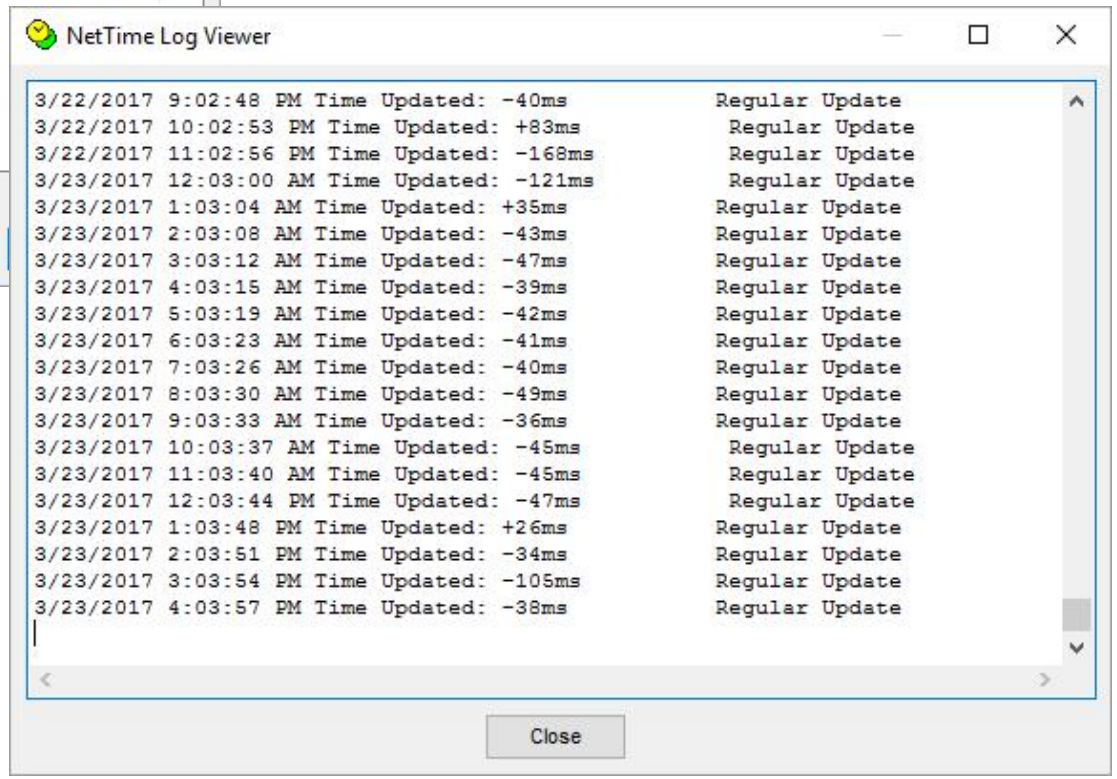
Hardware Details

- Interface – Audio type
  - PC sound card output to rig mike input
  - Rig audio out to PC sound card input
  - Simple or more elegant – hum control, level control
  - PTT control
- External Sound Card type
  - USB = bi-directional audio and rig control
- Rig
  - Fancy HF or $100 HF (Example: Kenwood TS-50)
  - 100-500 mw build-it-yourself kits (N7EP, K7JGM)
  - VHF or UHF mobile
- PC – Windows, Linux, Raspberry Pi
- Antenna – various, tuner if needed

Time Sync



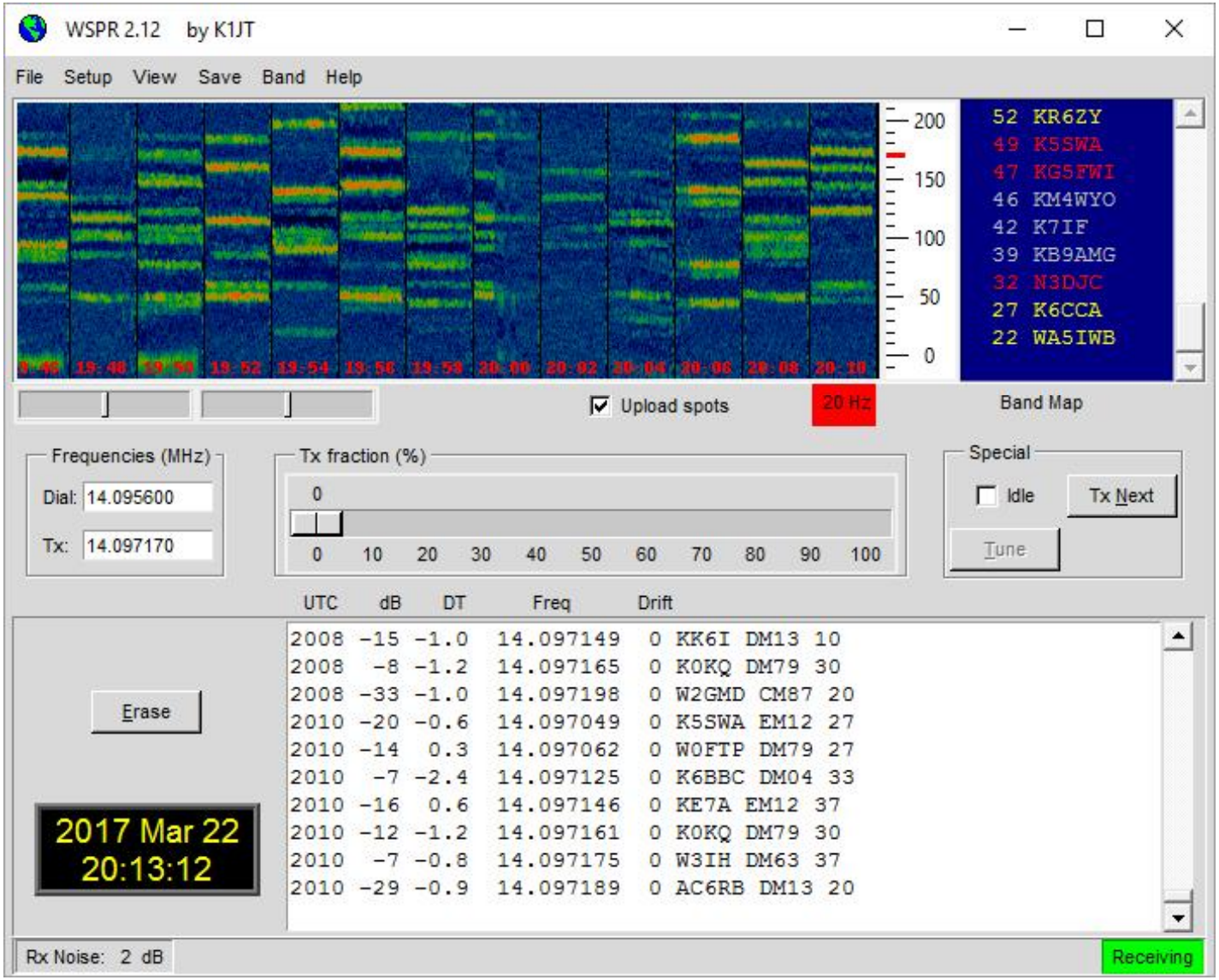
- NetTime, Dim4, others – free on internet
- Later Windows O/S have the function built-in



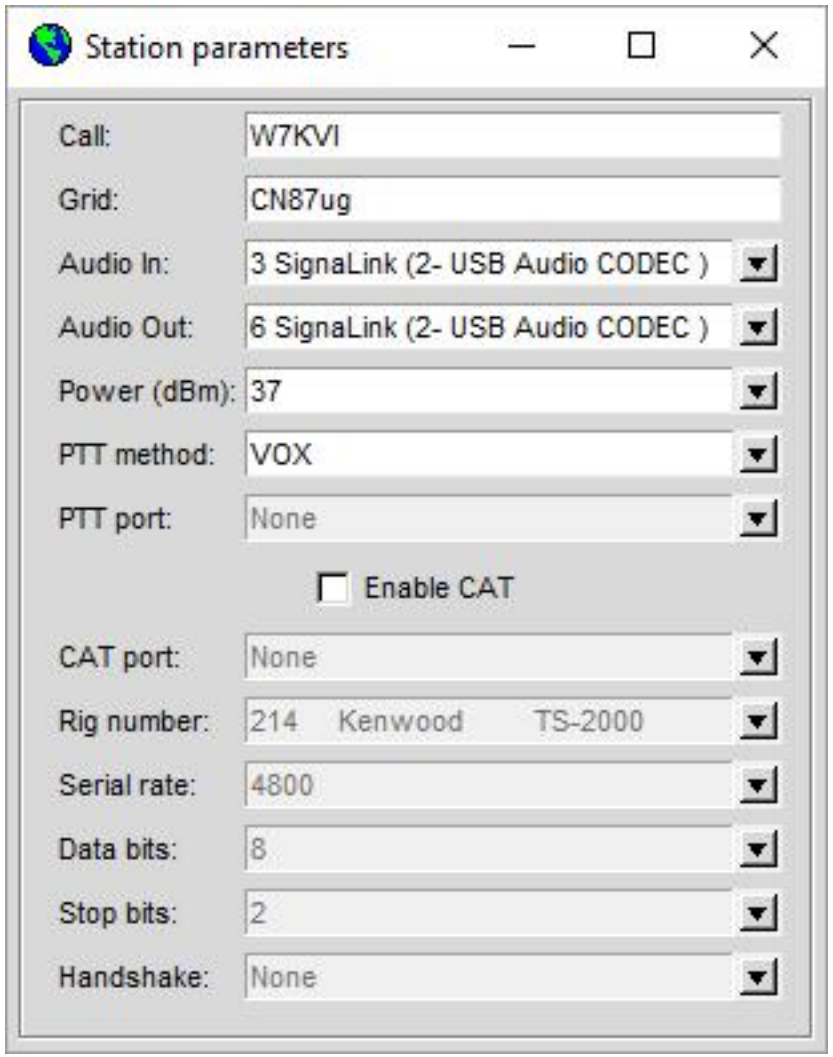
WSPR – Weak Signal Propagation Reporter

- By Joe Taylor, K1JT
- …designed for sending and receiving low-power transmissions to **test propagation paths** on the MF and HF bands
- Down to ~ -30 dB signal/noise ratio in voice bandwidth
- Standard Message – call, grid, power level
- Error Correction
- ~1.5 baud
- 4 tones @ 1.5 Hz sep
- 6 Hz bandwidth!
- 2 minute transmissions
- Must be time synchronized or few/no decodes

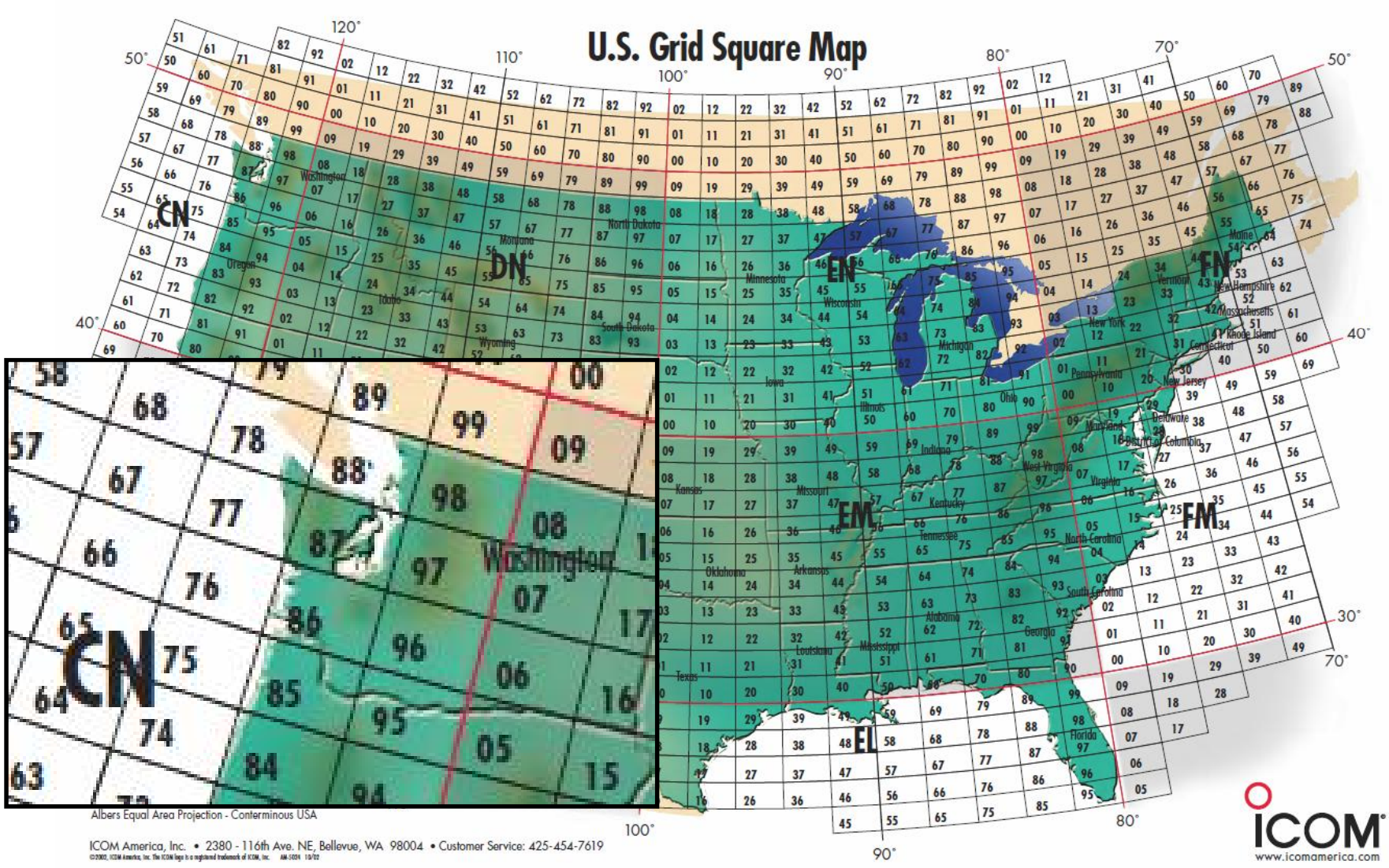
Basic WSPR Screen



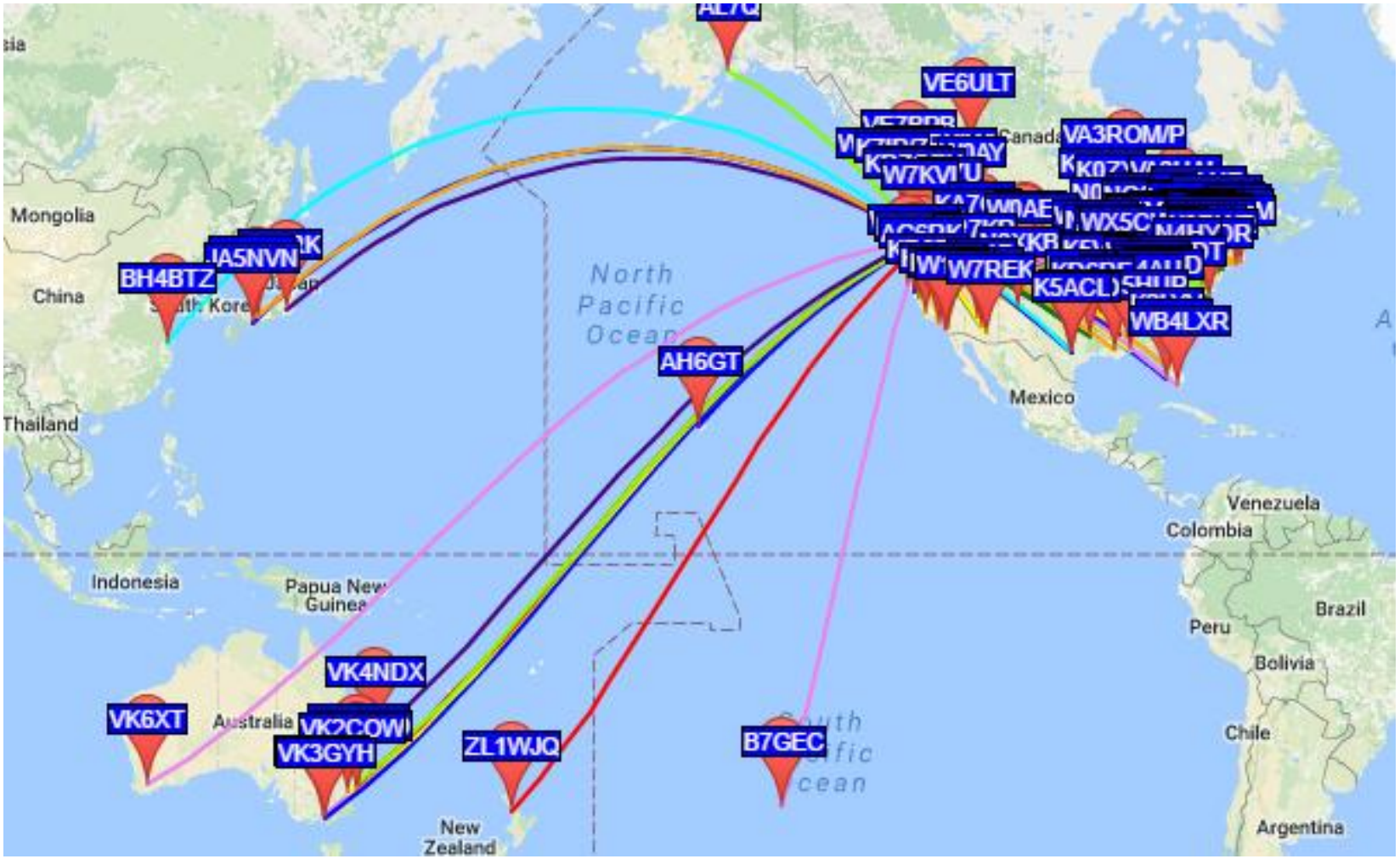
Setup Screen - WSPR



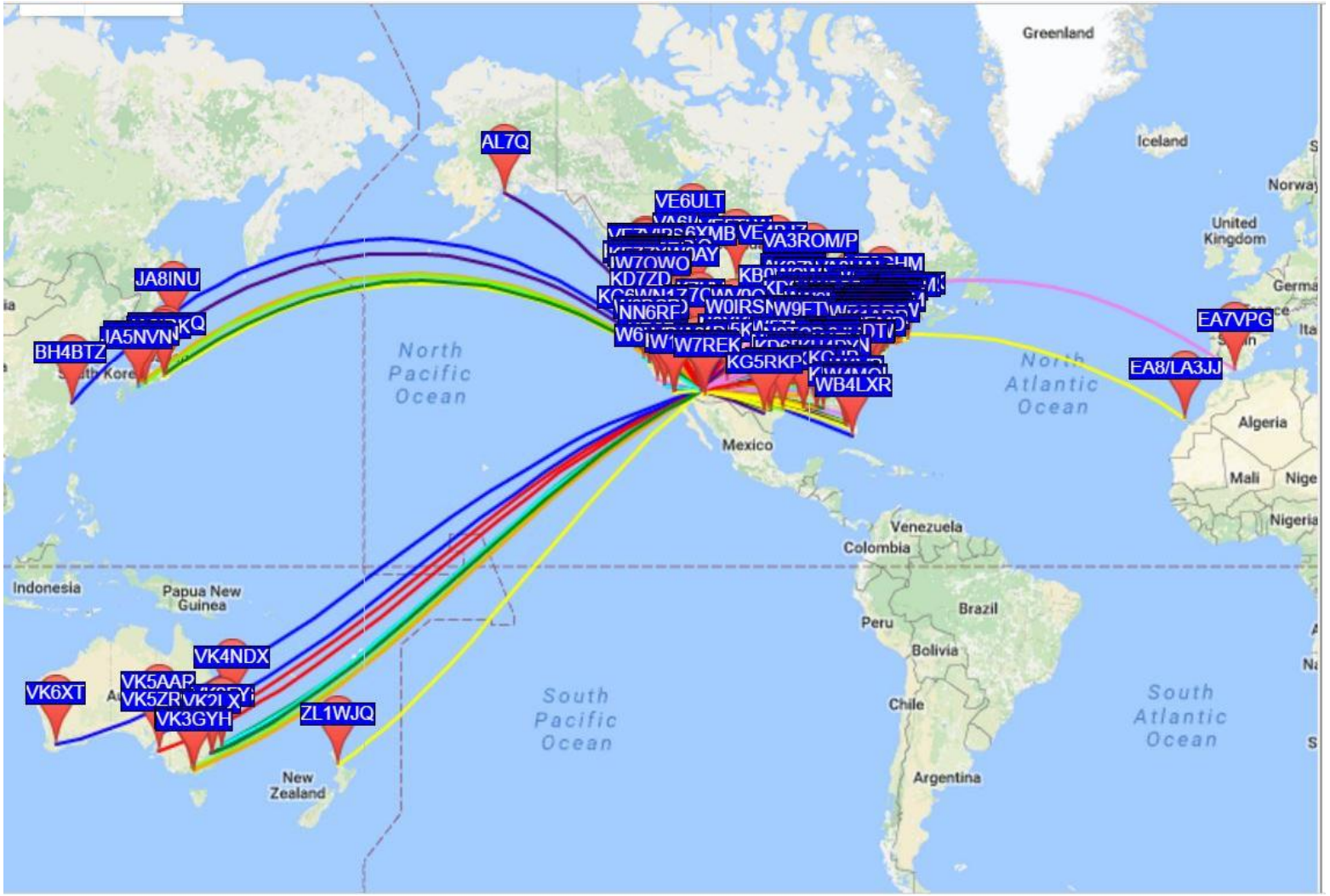
Grid Squares – W7KVI: CN87ug



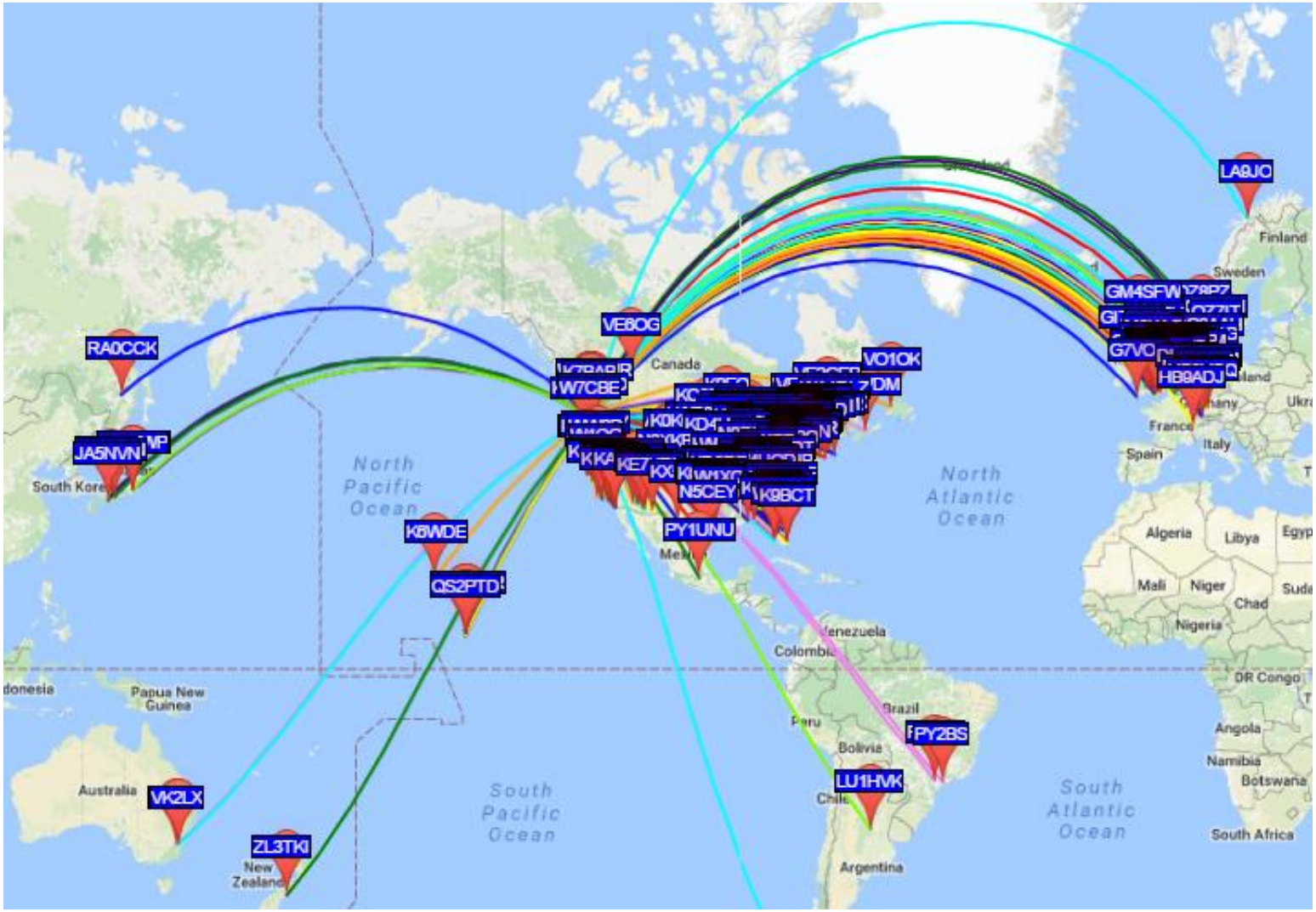
40m, 3/1/17, W7KVI from Oregon



40m, 3/1/17, N7EP

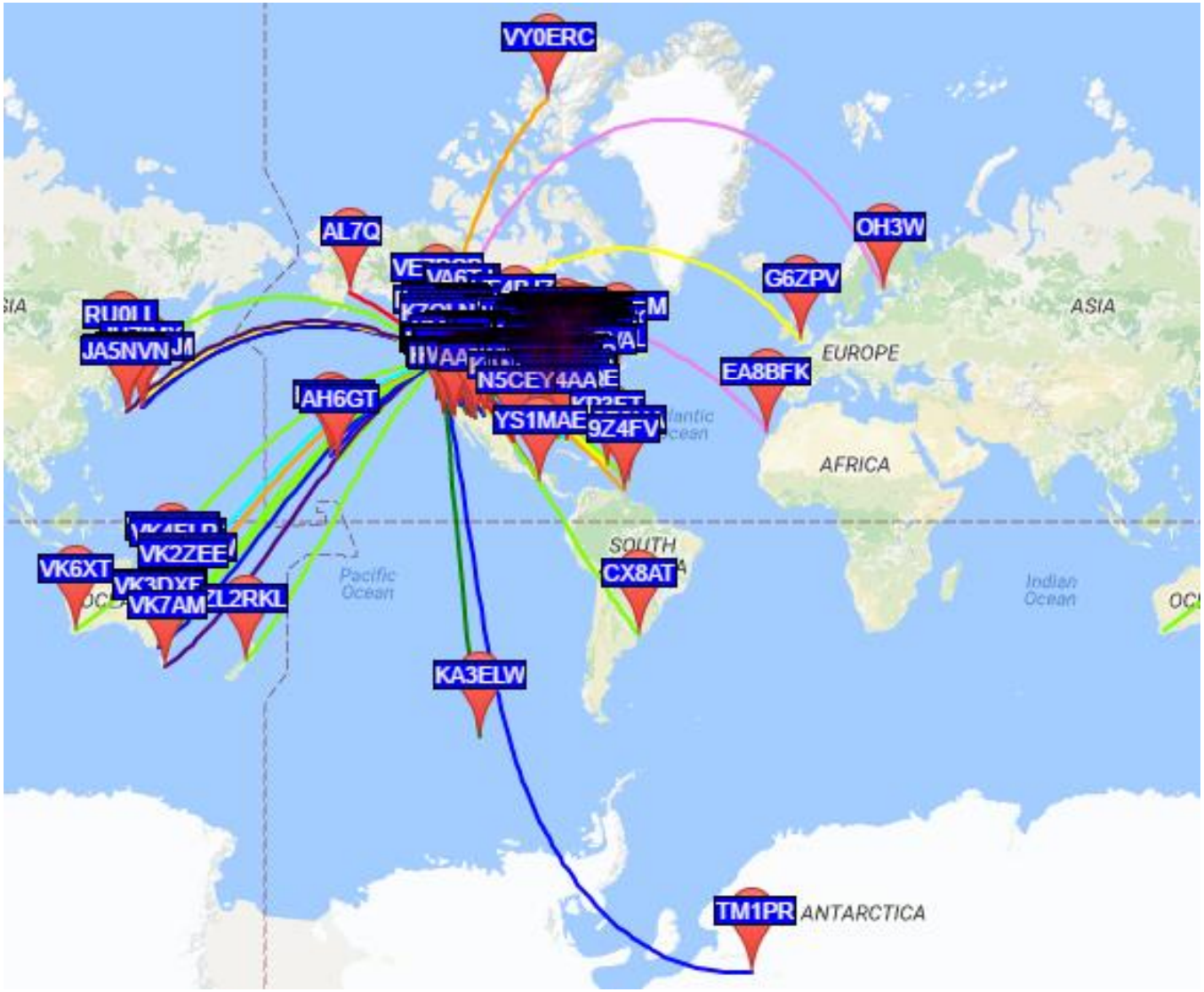


20m WSPR, W7KVI, 3/20/17



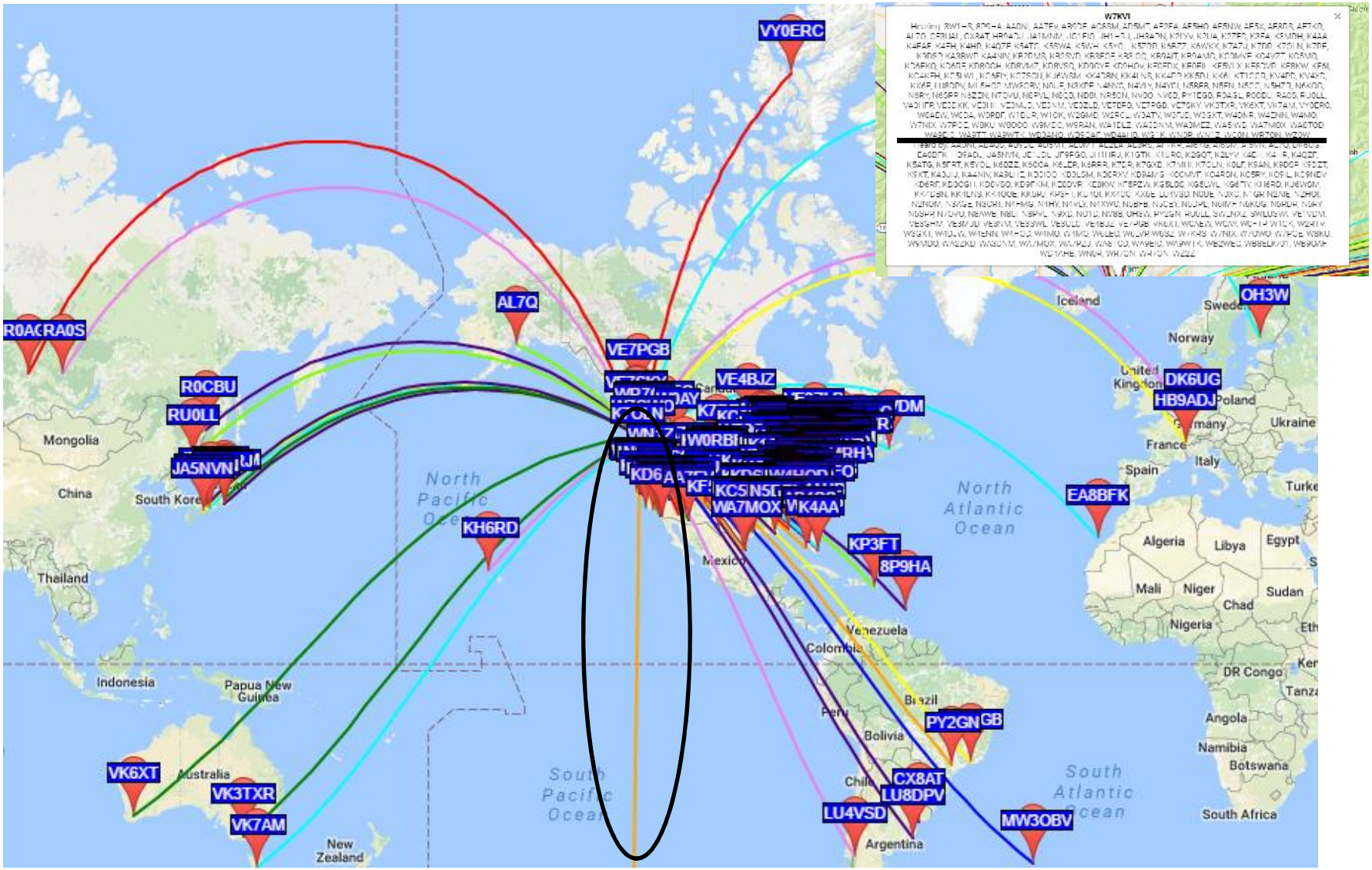
20m WSPR, W7KVI, 5/07/17

4 el beam @ 25', pointed SE – spots near each pole

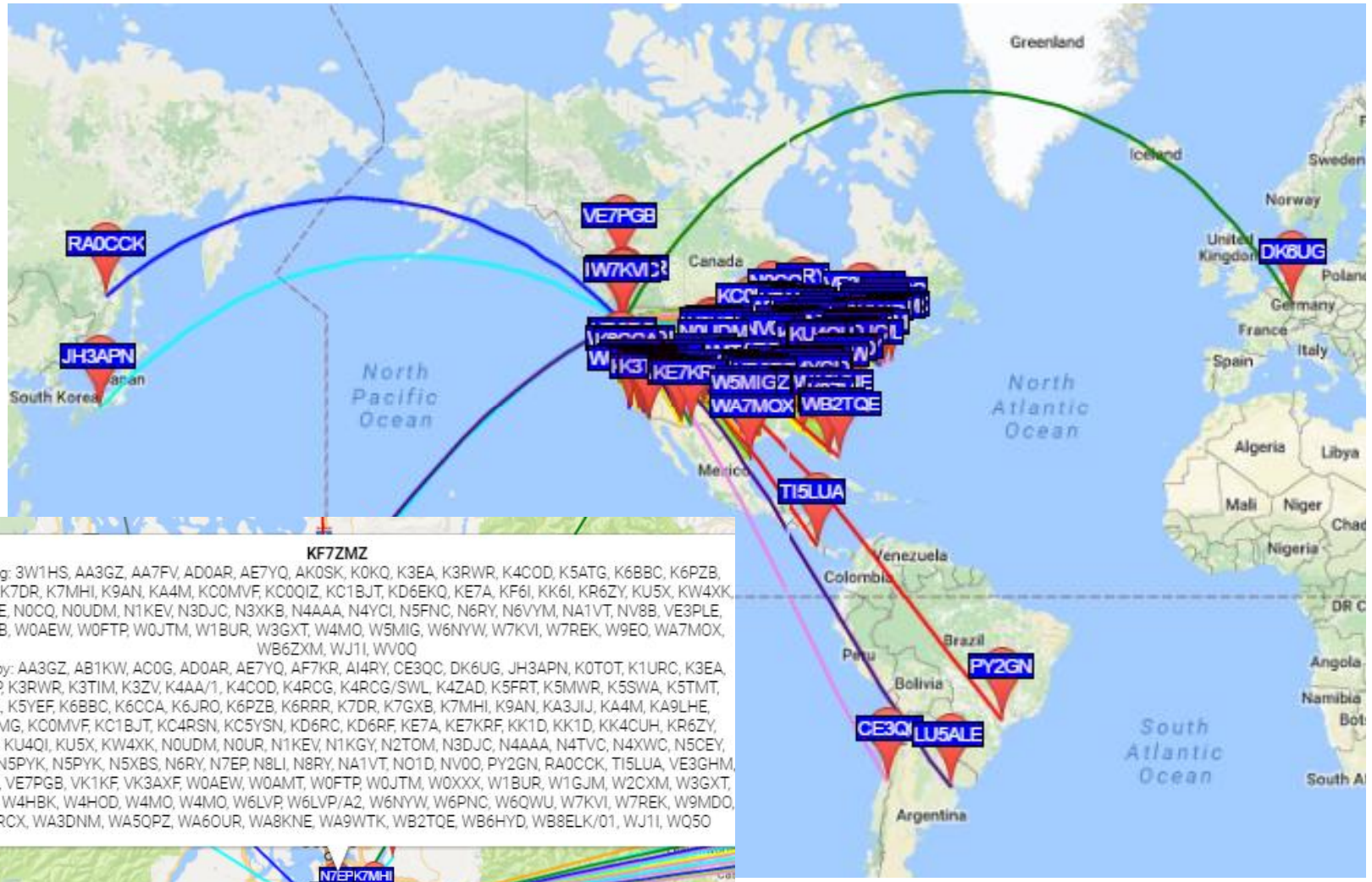


20m WSPR, W7KVI, 5/07/17

4-el beam @ 25’, pointed SE



KF7ZMZ, 3/23/17, 20m



KF7ZMZ

Hearing: 3W1HS, AA3GZ, AA7FV, AD0AR, AE7YQ, AK0SK, K0KQ, K3EA, K3RWR, K4COD, K5ATG, K6BBC, K6PZB, K6WKX, K7DR, K7MHI, K9AN, KA4M, KC0MVF, KC0QIZ, KC1BJT, KD6EKQ, KE7A, KF6I, KK6I, KR6ZY, KU5X, KW4XK, LU5ALE, N0CQ, N0UDM, N1KEV, N3DJC, N3XKB, N4AAA, N4YCI, N5FNC, N6RY, N6VYM, NA1VT, NV8B, VE3PLE, VE7PGB, W0AEW, W0FTP, W0JTM, W1BUR, W3GXT, W4MO, W5MIG, W6NYW, W7KVI, W7REK, W9EO, WA7MOX, WB6ZXM, WJ1I, WV0Q

Heard by: AA3GZ, AB1KW, AC0G, AD0AR, AE7YQ, AF7KR, AI4RY, CE3QC, DK6UG, JH3APN, K0TOT, K1URC, K3EA, K3FHP, K3RWR, K3TIM, K3ZV, K4AA/1, K4COD, K4RCG, K4RCG/SWL, K4ZAD, K5FRT, K5MWR, K5SWA, K5TMT, K5XL, K5YEF, K6BBC, K6CCA, K6JRO, K6PZB, K6RRR, K7DR, K7GXB, K7MHI, K9AN, KA3JIJ, KA4M, KA9LHE, KB9AMG, KC0MVF, KC1BJT, KC4RSN, KC5YSN, KD6RC, KD6RF, KE7A, KE7KRF, KK1D, KK1D, KK4CUH, KR6ZY, KT4LH, KU4QI, KU5X, KW4XK, N0UDM, N0UR, N1KEV, N1KGY, N2TOM, N3DJC, N4AAA, N4TVC, N4XWC, N5CEY, N5FNC, N5PYK, N5PYK, N5XBS, N6RY, N7EP, N8LI, N8RY, NA1VT, NO1D, NV0O, PY2GN, RA0CCK, TI5LUA, VE3GHM, VE3PLE, VE7PGB, VK1KF, VK3AXF, W0AEW, W0AMT, W0FTP, W0JTM, W0XXX, W1BUR, W1GJM, W2CXM, W3GXT, W4DJW, W4HBK, W4HOD, W4MO, W4MO, W6LVP, W6LVP/A2, W6NYW, W6PNC, W6QWU, W7KVI, W7REK, W9MDO, WA0RCX, WA3DNM, WA5QPZ, WA6OUR, WA8KNE, WA9WTK, WB2TQE, WB6HYD, WB8ELK/01, WJ1I, WQ5O

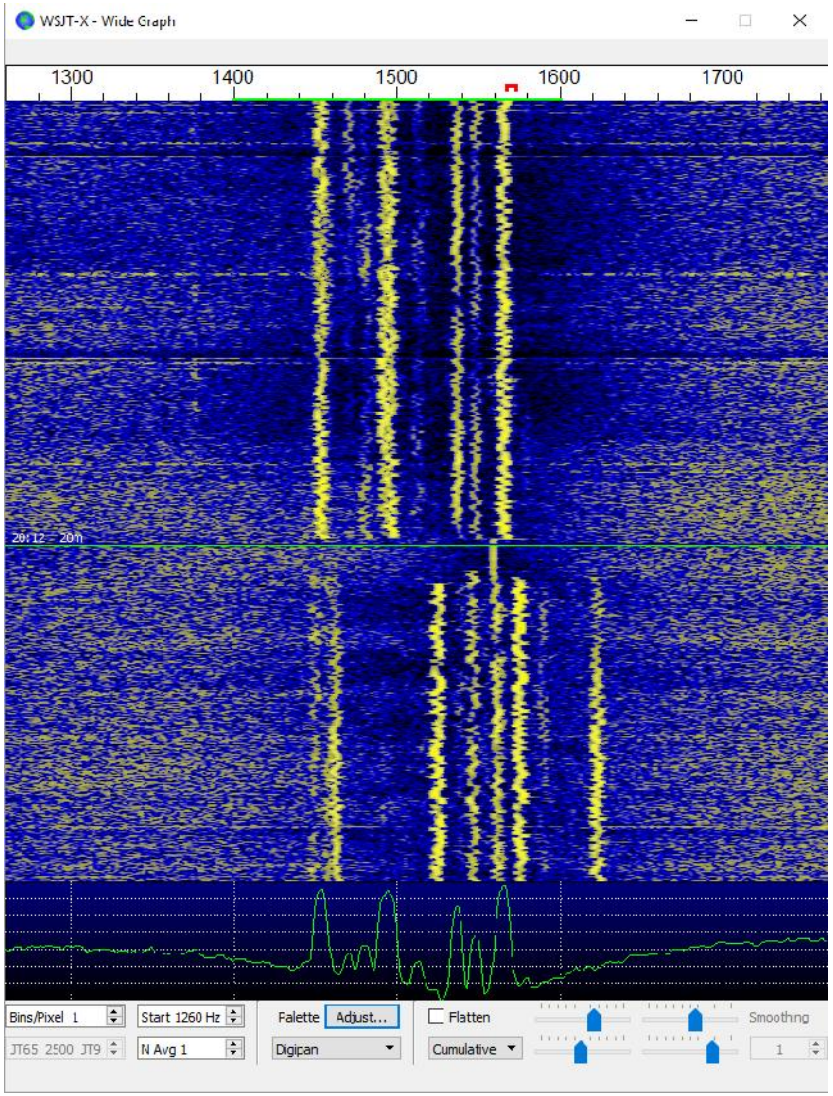
WSPR Database

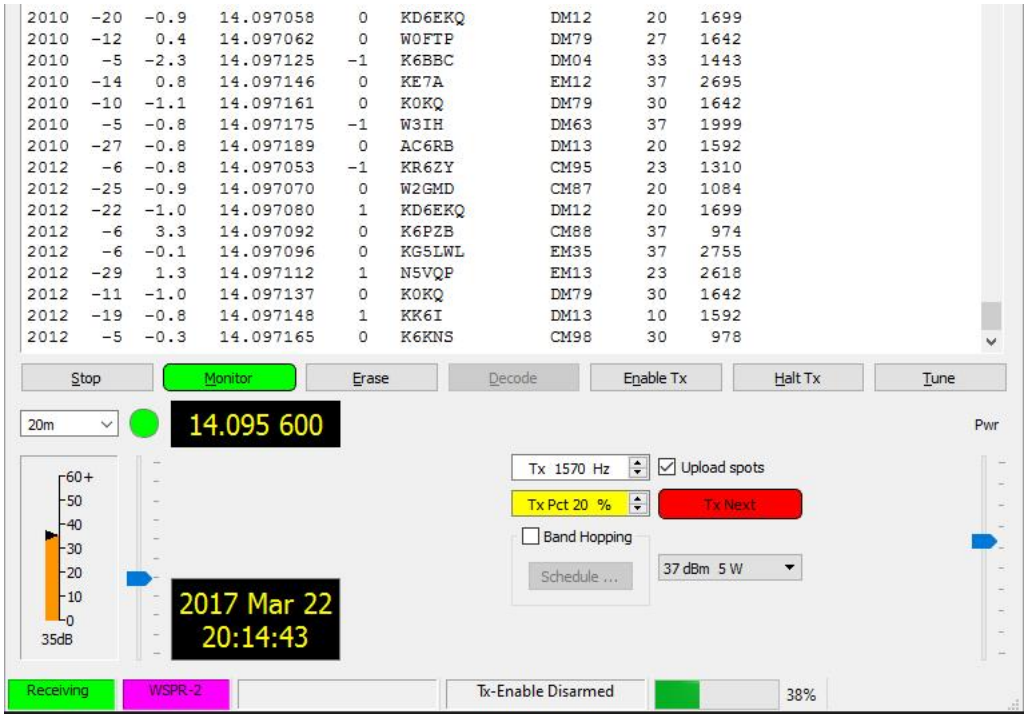
Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2017-03-21 18:38	W7KVI	14.097168	-19	-2	CN87ug	5	VE3PLE	FN25bg	3522	76
2017-03-21 18:38	W7KVI	14.097199	-21	-1	CN87ug	5	K5SWA	EM12ox	2668	117
2017-03-21 18:38	W7KVI	14.097166	-19	-1	CN87ug	5	N4XWC	EM63nu	3305	104
2017-03-21 18:38	W7KVI	14.097168	+6	-1	CN87ug	5	K9AN	EN50wc	2835	94
2017-03-21 18:38	W7KVI	14.097171	-13	-1	CN87ug	5	W4HOD	EM72eo	3482	105
2017-03-21 18:38	W7KVI	14.097169	-17	-1	CN87ug	5	KE7KRF	DM51kw	2038	142
2017-03-21 18:38	W7KVI	14.097166	-2	-1	CN87ug	5	NO1D	DM34tn	1637	146
2017-03-21 18:38	W7KVI	14.097135	-23	-1	CN87ug	5	N5CEY	EL16gc	3204	129
2017-03-21 18:38	W7KVI	14.097180	-15	-1	CN87ug	5	AI4RY	EM72go	3494	104
2017-03-21 18:38	W7KVI	14.097172	-19	-2	CN87ug	5	KU4QI	EM87bx	3271	94
2017-03-21 18:38	W7KVI	14.097171	-17	-1	CN87ug	5	KK4CUH	EM77qv	3219	95
2017-03-21 18:38	W7KVI	14.097188	-20	-1	CN87ug	5	K4RCG	FM08si	3658	89
2017-03-21 18:38	W7KVI	14.097182	-13	-1	CN87ug	5	W4MO	EL86	4122	110
2017-03-21 18:38	W7KVI	14.097184	-16	-3	CN87ug	5	W4DJW	EM84ux	3571	98
2017-03-21 18:38	W7KVI	14.097174	-12	-1	CN87ug	5	KC4RSN	EM72hp	3498	104
2017-03-21 18:38	W7KVI	14.097151	-12	-1	CN87ug	5	VE3SWL	EN93	3211	82
2017-03-21 18:38	W7KVI	14.097170	-7	-1	CN87ug	5	W4HBK	EM60	3533	109
2017-03-21 18:38	W7KVI	14.097137	-24	-1	CN87ug	5	AE5II	EM10tp	2881	121
2017-03-21 18:38	W7KVI	14.097169	-5	-1	CN87ug	5	KE7A	EM12kx	2645	118
2017-03-21 18:38	W7KVI	14.097196	-22	-1	CN87ug	5	K4RCG	FM08si	3658	89
2017-03-21 18:38	W7KVI	14.097168	-19	-1	CN87ug	5	K4COD	EM73sc	3533	103
2017-03-21 18:38	W7KVI	14.097139	-12	-2	CN87ug	5	KD6RF	EM22	2824	116
2017-03-21 18:38	W7KVI	14.097176	-23	-3	CN87ug	5	K4RCG	FM08si	3658	89
2017-03-21 18:38	W7KVI	14.097202	-24	-1	CN87ug	5	W2CXM	FN12sk	3600	81

KF7ZMZ to W7KVI 3/23/17 afternoon Ground Wave Propagation < 10 miles

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2017-03-23 23:16	KF7ZMZ	14.097046	-18	-1	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 23:16	KF7ZMZ	14.097047	-17	-1	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 23:04	KF7ZMZ	14.097046	-15	0	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 22:52	KF7ZMZ	14.097046	-20	-1	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 22:40	KF7ZMZ	14.097045	-17	1	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 22:30	KF7ZMZ	14.097027	-29	-4	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 22:30	KF7ZMZ	14.097046	-15	-1	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 22:08	KF7ZMZ	14.097046	-11	-2	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 21:18	KF7ZMZ	14.097046	-14	0	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 20:58	KF7ZMZ	14.097046	-12	0	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 20:48	KF7ZMZ	14.097046	-15	-1	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 20:38	KF7ZMZ	14.097046	-13	0	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 20:30	KF7ZMZ	14.097046	-16	-1	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 20:22	KF7ZMZ	14.097045	-13	0	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 19:50	KF7ZMZ	14.097046	-12	-1	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 19:42	KF7ZMZ	14.097046	-13	0	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 19:32	KF7ZMZ	14.097046	-17	0	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 19:12	KF7ZMZ	14.097046	-17	0	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 19:02	KF7ZMZ	14.097046	-14	-1	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 18:50	KF7ZMZ	14.097046	-13	0	CN87uj	5	W7KVI	CN87ug	14	180
2017-03-23 18:16	KF7ZMZ	14.097046	-15	0	CN87uj	5	W7KVI	CN87ug	14	180

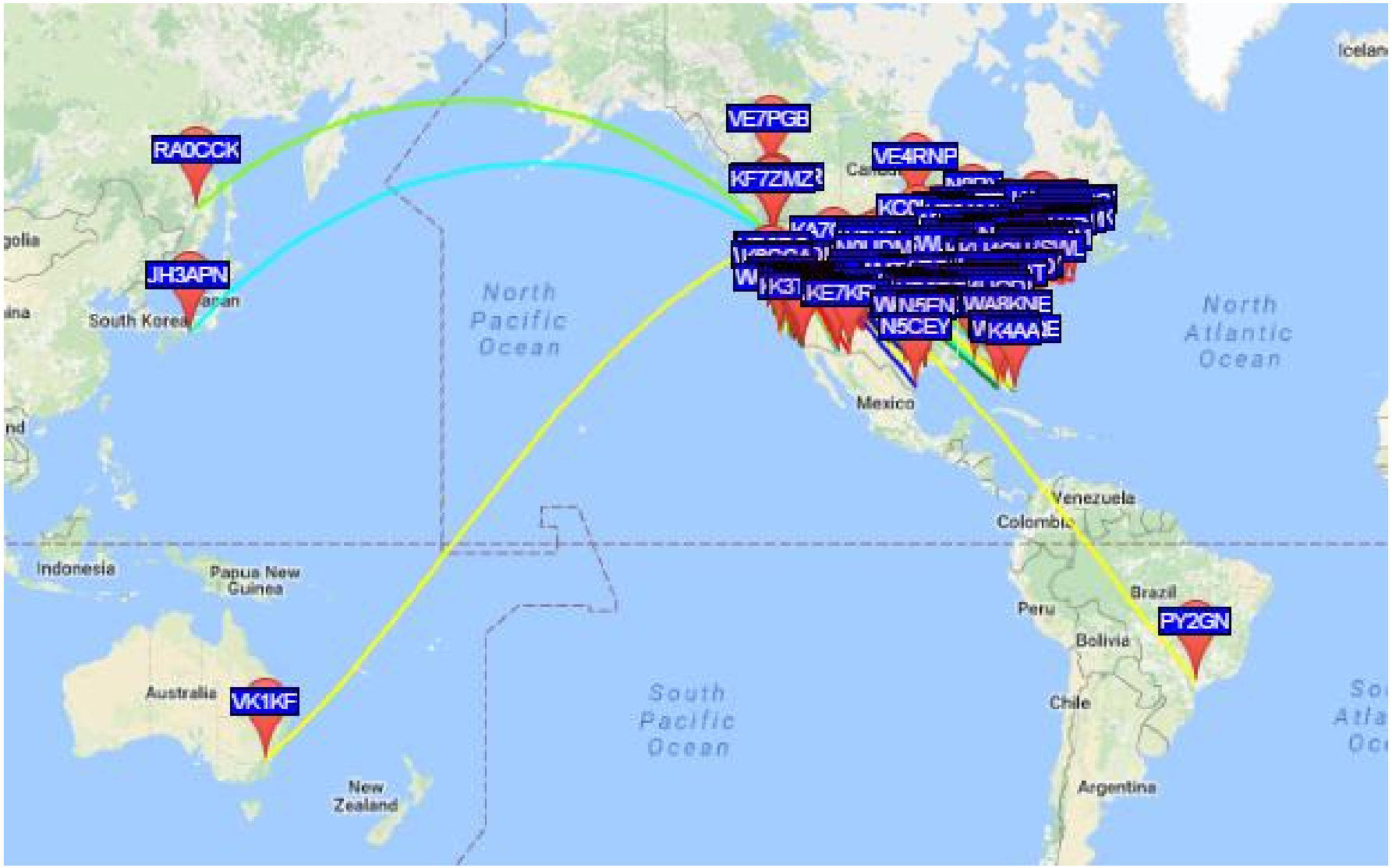
WSJT-X (Alternative WSPR Software)
Better Spectral Presentation





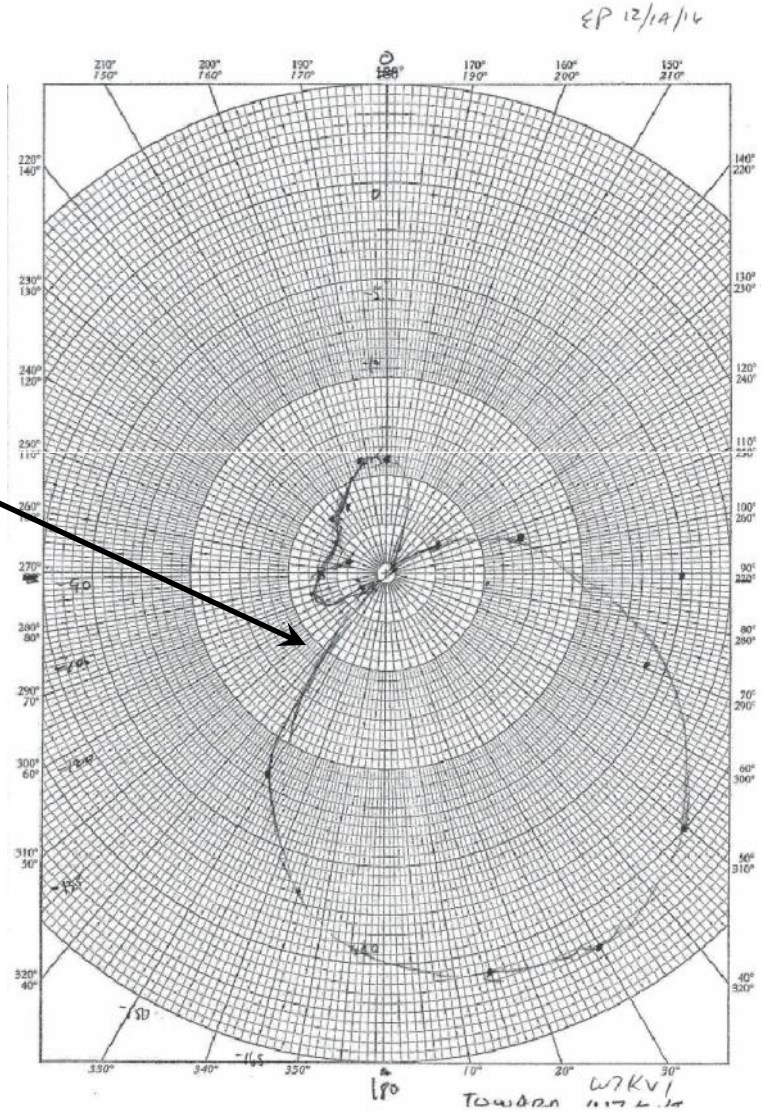
20m Dipole, ~7’ AGL

W7KVI 3/23/17, 7’ 20m Dipole, 12 hrs



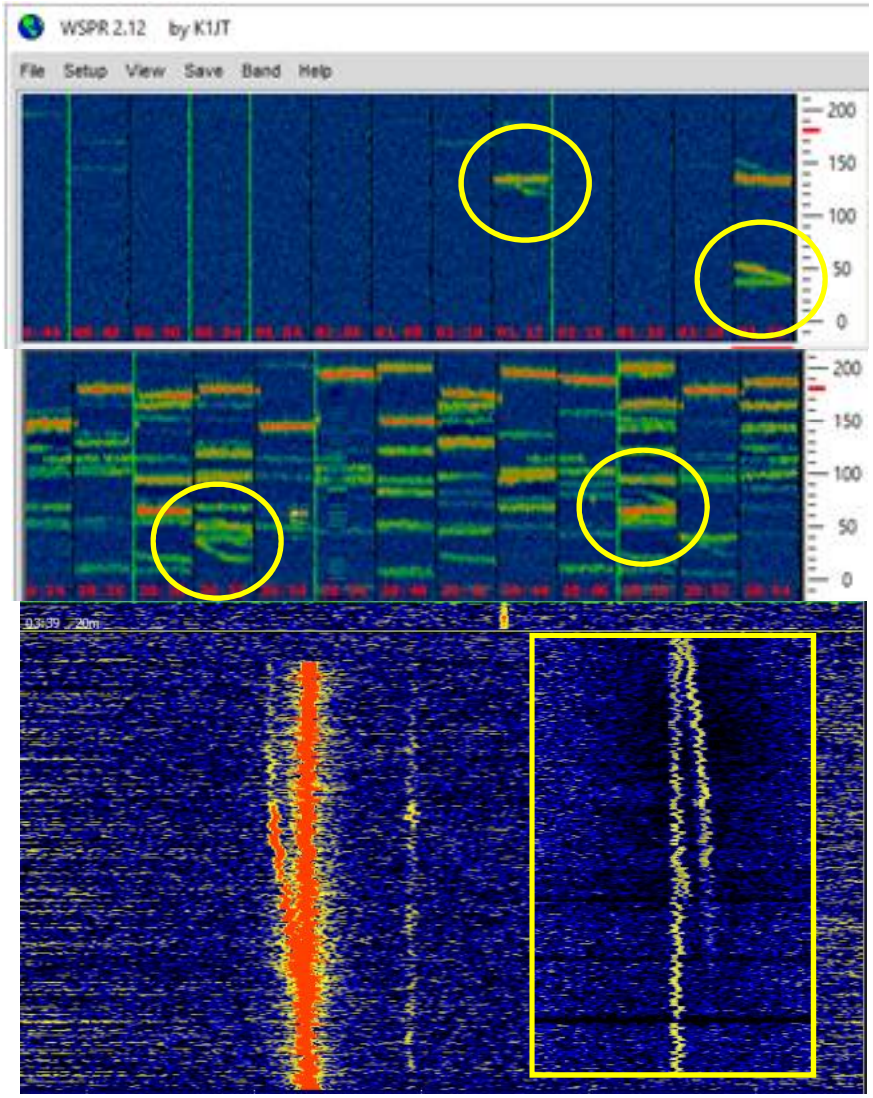
What to do with WSPR?

- Test Antennas
  - One against another (takes some time)
  - Plot beam patterns
- Learn propagation trends for various bands (e.g., night/day, winter/summer)
- Determine if aircraft are landing or taking off

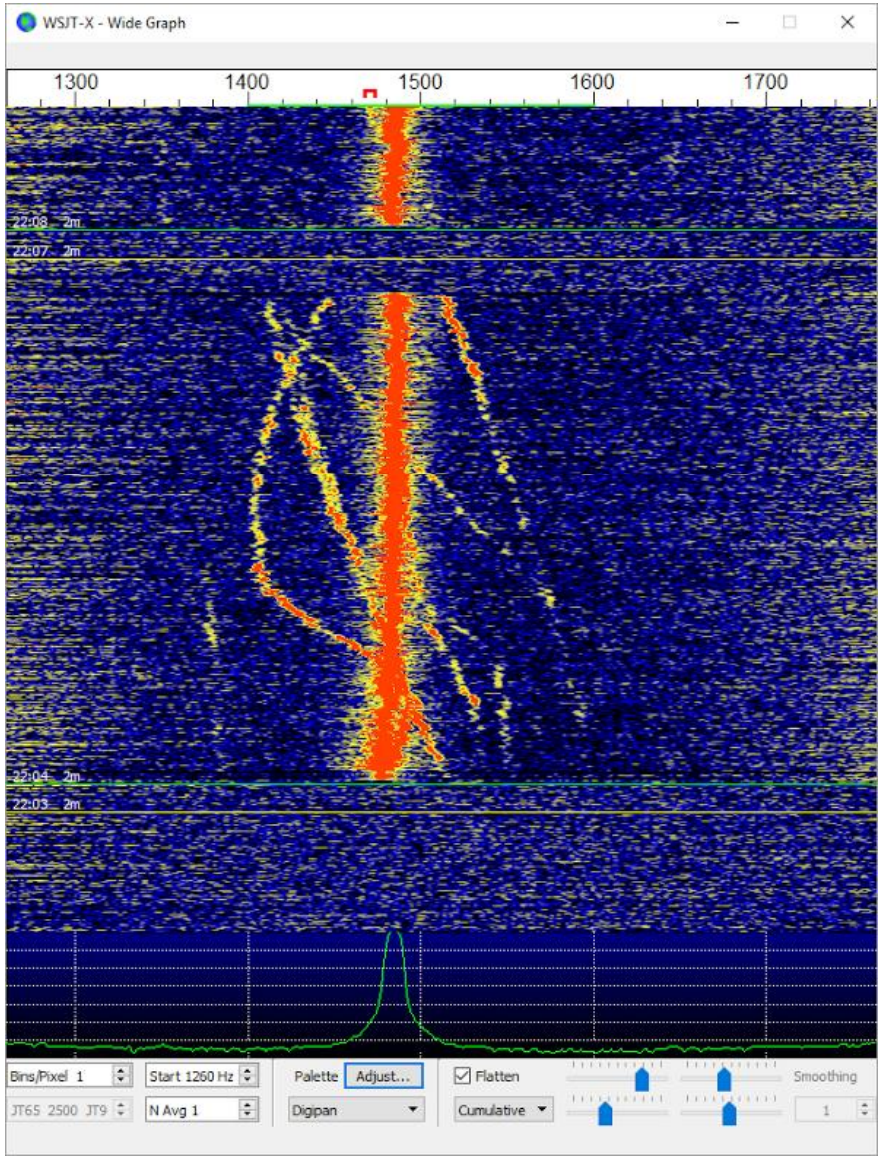


WSPR Whiskers

- 12/16 – began noticing “whiskers” on WSPR sigs
- Almost always N7EP, K7JGM as viewed by W7KVI, or reverse
- Caused by reflections off aircraft to/from Sea-Tac, with Doppler shift due to their motion
- Higher bands would have more Doppler shift, so….



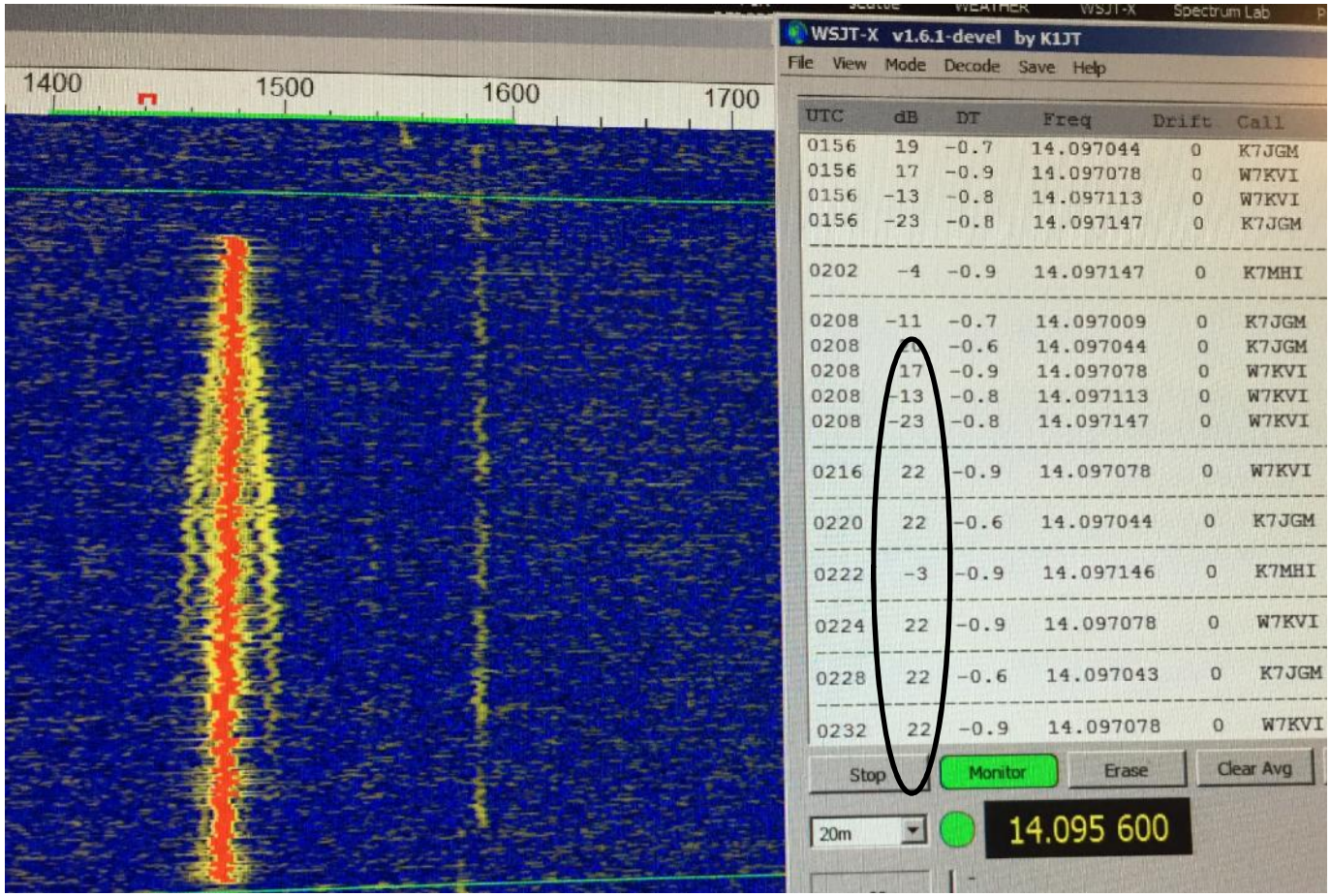
WSPR on 2m, N7EP to W7KVI



- Movements of 7 aircraft visible
- Some apparently not landing or taking off between EP and KVI, but maneuvering

WSPR on 20m, W7KVI to N7EP

- Double Sideband! Appears as AM on WSPR signal
- Apparently not aircraft reflection, or strange case of double Doppler signals; note S/N ratio of >20 dB (?)



Live Demo Time