WSPR (pronounced whisper) Weak Signal Propagation Reporter on the FlexRadio 1500

By Paul Boltwood VE3PLE paul@boltwood.ca March 3, 2015

What Is WSPR?

- A HF digital communications protocol good for DX
- Provides propagation data for other radio amateurs
- Does not support conventional QSO's. No QSLs
- World wide contacts with <100 mW
- 5 W max usually
- Not enough stations (<1000) or locations
- Very narrow bandwidth of 6 Hz gives good SNR
- Requires high frequency stability and accuracy (to ~1 Hz), & accurate time (to ~1 sec. via the Internet)
- Uses an Internet database to log all contacts

Operation

- Worldwide it runs on a 2 minute cycle
- Every station starts either to transmit or to receive on each even clock minute
- At random, you transmit on about 20% of all of the cycles
- Transmissions are at a user chosen frequency in a 200 Hz wide subband within each amateur band
- All transmitting and receiving is automatically computer controlled and computer data processed by WSPR.EXE

Messages

- WSPR messages are digital and well protected
- Each message contains in 50 bits: call sign, Maidenhead locator, output power in dBm
- plus forward error correction to total 162 bits per message
- Data rate of 1.4648 baud, continuous phase 4-FSK modulation
- Your computer decodes all received transmissions in the 200 Hz sub band at once

Software – WSPR.EXE

- Wspr.exe from Joe Taylor decodes the audio received by a transceiver to:
 - Isolate the 200 Hz sub band
 - Separate the individual signals
 - Decode all of the messages and display them
- Wspr.exe generates the audio to be transmitted too
- Wspr.exe is somewhat buggy total crashes happen after days of running. Cycle power completely to recover

Software - VSPMgr

- VSPMgr is needed to provide virtual COM ports so two software packages that normally would talk to COM I/O, can talk directly to each other in the same computer
- It is needed for CAT port transceiver control on the Flex 1500 from WSPR.EXE
- See

http://k5fr.com/ddutilwiki/index.php?title=VS

<u>PM</u>. You must be licensed but it is free

Transceiver Audio Connections

- WSPR.EXE expects the use of archaic SSB transceivers rather than full digital!
- Audio must flow both ways between your PC and your SSB transceiver
- The old way is to use phono cables and 2 audio cards
- Modern way is all digital using Virtual Audio Cable software (which costs \$35. Version 4.13 has a nasty bug)
- My rig has no wired audio connections

My Rig (only Flex 1500, computer and a PS is needed for WSPR)



Antenna is a Cushcraft R8 (modified so it doesn't fall down), bands 40m to 6m vertical

as an

WSPR

FlexRadio 1500 Transceiver

- This little (10.2 cm x 5.1 cm x 15.2 cm) \$650 box provides the RF to audio interface for HF/6m
- With a good computer, it equals much more expensive conventional hardware
- It has some bugs cycle all power to fix
- Thanks to Doug Leach for pushing me into it

Most Of The Real Transceiver



The Real Transceiver Revealed Rating:



7.8 Windows Experience Index

| Processor: |
|-------------------------|
| Installed memory (RAM): |
| System type: |

Intel(R) Core(TM) i7-4820K CPU @ 3.70GHz 16.0 GB 64-bit Operating System



Several times more powerful than needed. Older dual core 3 GHz was too slow.

Rats Nest



Precision 10 MHz ovenized stable source for Flex 1500

FLEX-1500 Window Doing WSPR



Transmit passband between yellow lines

Receive passband (dark grey)

WSPR makes very effective use of the spectrum space it uses. Some say WSPR wastes spectrum space that should be used for SSB. Here we have 5 signals in 200 Hz.



Some People Do Not Like WSPR



WSPR Extra Windows



VAC (virtual audio cable) replaces all audio connections with digital over USB. Bug - you must refresh the Audio In and Out each time you start WSPR.EXE – ugh!

WSPR.NET

- A web site that records all WSPR messages sent and received world-wide in a data base
- Propagation statistics are computed from this data to predict what amateur band communications are possible at the time
- You can tailor displays to see how you are doing, both what stations you have received and what stations have heard you

WSPR.NET Display Control

Spot Database Query

Band

All

Show only spots on this band.

.

Count

| 200 | |
|-----|----|
| | ۱. |
| 000 | |

Maximum number of spots to show

Call

Only show spots of this callsign

Reporter

VE3PLE

Only show spots reported by this call. If same as "Call", then show spots of this call OR heard by this call.

In last

Two Weeks 🔻

Consider spots only of this recent time period

Sort by

Distance 🔻

Field to sort by

Reverse

Check to reverse sort order

Unique

Check to show only unique call/reporter combinations

Update

WSPR.NET Spot Database Samples

| Timestamp | Call | MHz | SNR | Grid | Pwr | Reporter | RGrid | km | az |
|------------------|--------|-----------|-----|--------|-----|----------|--------|-------|-----|
| 2014-12-04 12:40 | VE3PLE | 7.040027 | -21 | FN25bg | 5 | VK6ZT | OF78sq | 18175 | 324 |
| 2014-11-30 10:38 | VE3PLE | 10.140131 | -22 | FN25bg | 5 | VK5KJP | PF95fc | 16903 | 280 |
| 2014-12-09 13:42 | VE3PLE | 7.040019 | -28 | FN25bg | 5 | VK5EI | PF95gc | 16897 | 280 |
| 2014-12-03 21:04 | VE3PLE | 14.097022 | -21 | FN25bg | 5 | VK5MR | PF96lh | 16792 | 281 |
| 2014-12-02 11:38 | VE3PLE | 7.040020 | -19 | FN25bg | 5 | VK3CRG | QF21ex | 16612 | 269 |
| 2014-11-30 09:38 | VE3PLE | 10.140117 | -18 | FN25bg | 5 | VK7TW | QE37pc | 16598 | 259 |
| 2014-12-03 00:18 | VE3PLE | 14.097025 | -25 | FN25bg | 5 | VK7ZGK | QE37pd | 16597 | 259 |
| 2014-12-03 20:46 | VE3PLE | 14.097011 | -21 | FN25bg | 5 | VK7ZL | QE37pd | 16597 | 259 |

These are the top lines out of hundreds of lines, all in reverse distance order

100 mW Gets To Large Distances

| Timestamp | Call | MHz | SNR | Drift | Grid | Pwr | Reporter | RGrid | km | az |
|------------------|--------|-----------|-----|-------|--------|-----|---------------|--------|----------------------|-----|
| 2014-05-11 07:18 | VE3PLE | 14.097193 | -26 | 0 | FN25bg | 0.1 | VK1BF | QF44 | 161 <mark>2</mark> 1 | 270 |
| 2014-05-12 10:52 | VE3PLE | 14.097194 | -29 | 0 | FN25bg | 0.1 | VK4ZBV | QG62ml | 15300 | 278 |
| 2014-05-13 10:08 | VE3PLE | 14.097194 | -29 | 0 | FN25bg | 0.1 | VK4NE | QG62nj | 15299 | 277 |
| 2014-05-15 04:46 | VE3PLE | 14.097190 | -27 | 1 | FN25bg | 0.1 | ZL3DMH | RE66im | 14731 | 246 |
| 2014-05-10 07:40 | VE3PLE | 10.140144 | -26 | 0 | FN25bg | 0.1 | WA2YUN | RK39hh | 10465 | 303 |
| 2014-05-08 21:18 | VE3PLE | 14.097188 | -25 | 0 | FN25bg | 0.1 | 4X1RF | KM72ls | 8893 | 53 |
| 2014-05-07 23:02 | VE3PLE | 14.097197 | -21 | 1 | FN25bg | 0.1 | PY2GN | GG56tv | 8097 | 154 |
| 2014-05-07 23:22 | VE3PLE | 14.097194 | -28 | 0 | FN25bg | 0.1 | IZ3ATV | JN55vk | 6477 | 56 |

Me Receiving

| Timestamp | Call | MHz | SNR | Drift | Grid | Pwr | Reporter | RGrid | km | - |
|------------------|---------|-----------|-----|-------|--------|------|----------|--------|-------|---|
| 2014-05-19 18:08 | 2D5NIL | 14.097143 | -11 | 0 | NF25 | 1000 | VE3PLE | FN25bg | 17998 | ŝ |
| 2014-05-18 07:00 | VK5AK | 14.097129 | -17 | 0 | PF95jd | 1 | VE3PLE | FN25bg | 16875 | |
| 2014-05-11 11:16 | VK5WMT | 14.097042 | -12 | 0 | PF95jn | 5 | VE3PLE | FN25bg | 16850 | |
| 2014-05-16 10:40 | VK5MR/P | 14.097097 | -15 | 0 | PF96lg | 2 | VE3PLE | FN25bg | 16794 | |
| 2014-05-15 08:38 | VK5MR | 14.097107 | -12 | -1 | PF96lh | 10 | VE3PLE | FN25bg | 16792 | |
| 2014-05-12 06:38 | VK3PD | 14.097074 | -22 | 0 | QF21nt | 5 | VE3PLE | FN25bg | 16562 | |
| 2014-05-11 05:20 | VK3MG | 14.097127 | -22 | 0 | QF21nu | 5 | VE3PLE | FN25bg | 16560 | |
| 2014-05-19 08:18 | VK3DXE | 14.097176 | -14 | -1 | QF21nv | 50 | VE3PLE | FN25bg | 16558 | |

WSPR.NET Statistics

Stations Participating per Day (7-day moving average)



