

WSPR – Weak Signal Propagation Reporter

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WSPR stands for Weak Signal Propagation Reporter. It is one of the modes available in the popular WSJT-X software used by many hams for FT8 digital communication. If you have setup your radio and computer to run FT8, you are ready to try WSPR.

WSPR was designed to probe potential propagation paths using low-power transmissions and can operate over a wide range of amateur frequencies. Transmitter power is typically milliwatts to a few watts. Modulation is by frequency-shift keying and the information exchanged is call sign, 4-character grid and transmitted power. The transmission rate is quite slow requiring almost two minutes to transmit the 50 bytes of data. Forward error correction is used to assure accurate transfer of the information.

The WSPR interface in WSJT-X is shown below. Just set your transmitter power to 2W or less, choose the band in the software and tune-up. The default WSPR settings work fine. You can experiment with the other settings; you won't break anything.

WSJT-X v2.6.0-rc4 by K1JT et al.

File Configurations View Mode Decode Save Tools Help

UTC	dB	DT	Freq	Drift	Call	Grid	dBm	mi
2152	-1	0.2	14.097011	-1	K0CFW	EN34	23	932
2152	-2	0.0	14.097023	0	NOSL	EN42	23	821
2152	-2	0.2	14.097026	0	WB0RLJ	EN11	23	721
2152	-1	2.9	14.097042	0	W8AC	EN91	37	1074
2152	-6	0.3	14.097087	0	KG4KGY	EM77	23	739
2152	-5	0.1	14.097132	0	AC3V	FN10	37	1216
2152	-13	0.0	14.097145	-3	KG4ODC	EM85	23	778
2152	8	0.3	14.097160	0	KV6X	DM75	23	631
2152	8	0.2	14.097162	0	K4COD	EM73	33	631
2152	-11	0.2	14.097167	0	K4COD	EM73	33	631
2152	-17	0.3	14.097181	0	KB7CI	DM42	23	921
2152	-16	0.1	14.097187	0	WX9Z	EM68	23	697
2152	-21	0.1	14.097187	0	<...>	CM87XF	23	1578
2152	-14	0.4	14.097192	0	KD7BOW	DM54	23	823
2152	-5	0.4	14.097201	0	KK4NDU	EM60	23	502
2152	-8	0.3	14.097204	0	KG4WVL	EM83	23	744

20m

Stop Monitor Erase Decode Enable Tx Halt Tx Tune Menus

20m **14.095 600** Pwr

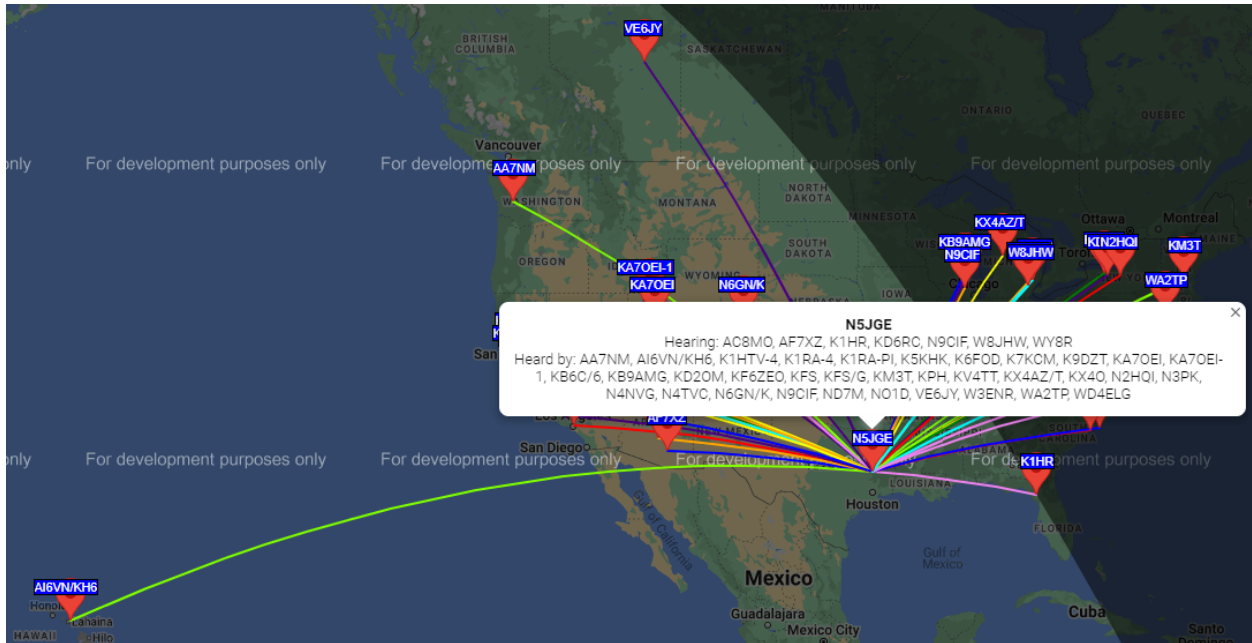
H FT8 FT4 MSK Q65 JT65 **2022 Dec 26 21:54:35**

Tx 1500 Hz Upload spots
Tx Pct 20 % Prefer Type 1 messages
 Band Hopping No own call decodes
Schedule ... Tx Next
30 dBm 1 W

Receiving IC7300 WSPR 0 35/120

A WSPR station can be operated as receive only. If you want to receive only, then set the Tx Pct to "0". WSPR receiving stations can optionally report signals received to the [WSPRnet](https://wsprrnet.org/) website (see checkbox in WSJT-X "Upload spots"). This website provides data for amateurs to see where they are being heard. WSJT-X will also save your decoded signals in the log file named "ALL_WSPR.TXT".

To see who has heard you on the [WSPRnet](https://wsprrnet.org/) site, a free registration is required. Spots can be viewed on a map as shown in the figure below. To generate the map, click the "Map" link at the top right of the main page. Below the map, you set band, callsign, time period, etc. to view the results. If you click on any of the "map pins", a pop-up shows details of who that station is hearing and who they were heard by (if they are transmitting).

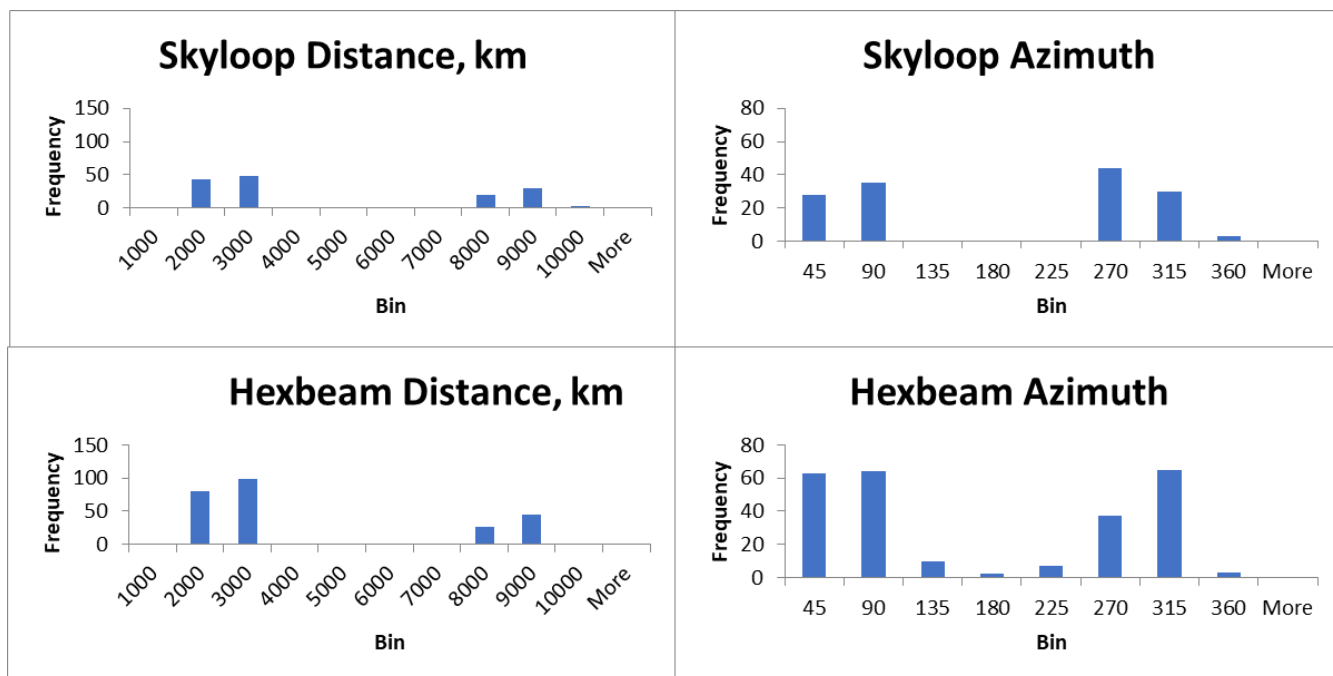


Note: Graphic is from the WSPRNET website for N5JGE on 17M at 1W (12/26/22, 2216UTC)

Similar to the map, there is a "Database" link at the top right of the main page. This opens a view where you can set band, callsign, time period, etc. to select the full data set for viewing. The plain text table can be copied / pasted into spreadsheet software for offline analysis.

Next, I will go over a simple example of comparing two of my antennas on 15M using 1W of power. The first antenna is a Skyloop cut for 80M at 25' elevation and the second is a Hexbeam at about 15' pointed due North. I ran WSPR using the Skyloop for about 30 minutes with 4 transmit cycles. Immediately after that test, I switched to the Hexbeam and ran WSPR again for about 30 minutes with 4 transmit cycles.

The graphs on the next page compare the distance and direction results. These graphs are called "histograms" and show the number of contacts in each "bin". Looking at the upper left graph, there 0 contacts between 0 and 1000 km (the "1000" bin), about 40 contacts between 1000 and 2000 km (the "2000" bin) and about 50 contacts between 2000 and 3000 km (the "3000" bin), etc.



Note: Results from WSPRNET website for N5JGE on 15M at 1W (12/26/22, 1410UTC)

Both antennas exhibited maximum distances of about 9000km (5400 miles) with 1W. The maximum distances were similar for both receiving and transmitting. The distance graphs (left two graphs) show a similar pattern. There is a group of contacts between 2000 and 4000 km (1200 – 2400 miles) and another at 7000 to 10,000 km (4000 – 6000 miles). This appears to be from F-layer propagation with 2 – 3 hops. Likewise, the azimuth results (right two graphs) are interesting.

The Hexbeam exhibits a broader spread of contacts than the Skyloop. Partly, this is due to where the receiving stations are located (east and west coasts) and partly due to the broad front-side pattern of the Hexbeam. Side and back lobe contacts are also apparent from the Hexbeam data at azimuths from 90 – 270 degrees.

The biggest difference between the two antennas was the total number of contacts during the same operating time. The Skyloop made 141 contacts, while the Hexbeam made 252, or 79% more contacts! The Skyloop contacts consisted of 55% received and 45% transmitted. The Hexbeam contacts were 37% receive and 63% transmit. Even though the Hexbeam has a broad pattern, it does concentrate power more uniformly into a smaller area. This higher power density is easier for receiving antennas to capture, so the Hexbeam transmits better.

The 80M Skyloop has many lobes and nulls on 15M, so poorer coverage and less concentration of power in many directions. However, the Skyloop has more much wire in the air and is a little higher, enabling it to capture weaker signals and giving better receive than transmit performance.

One caveat, since the tests were done one after another, things could have changed (besides the antennas) and affected the results. This type of test should be repeated a couple of times under different conditions to make sure the results are consistent and not a one-off event. For the ambitious, a much more rigorous way to compare antennas can be found [here](#).

What else can you do with WSPR? (from [Radio Amateur Society of Australia](#))

- Live propagation data between you and other WSPR stations
- Watch the behavior of propagation over time, the seasons and the sunspot cycle.
- See the bands open!
- Check out the practical performance of your antennas.
- Have fun seeing what countries and prefixes WSPR can work on low power.
- Can participate as a “receive only” station.

FYI, there are inexpensive transmitters and Raspberry Pi computers that can be dedicated to WSPR use in the shack. This frees up your main rig and computer while doing real-time propagation assessment with your antennas.

For further reading and learning

[WSPRnet](#)

[The \\$50 Ham](#)

[G4ILO's Shack](#)