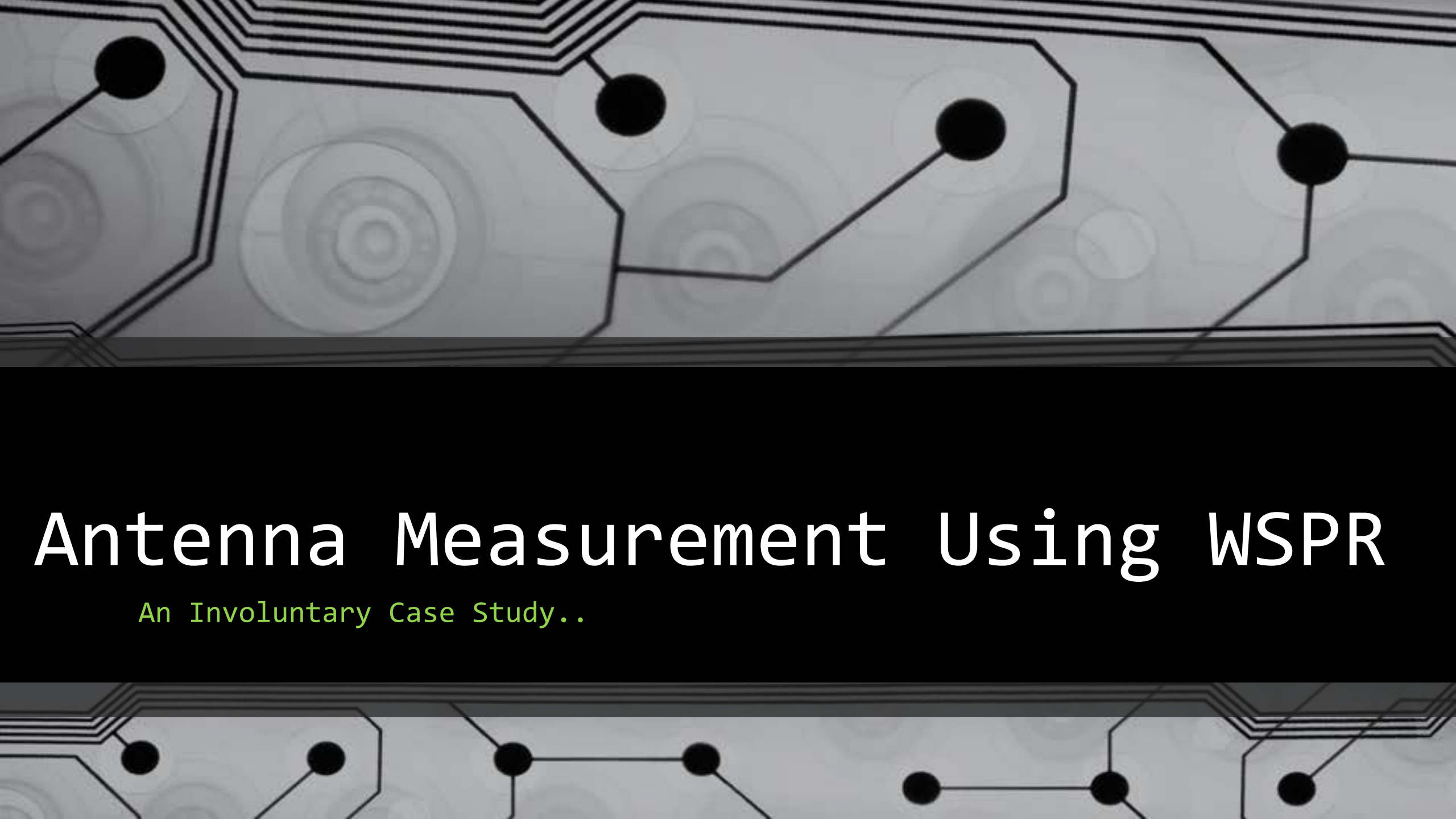


The background of the slide is a grayscale image of a circuit board. It features various traces, pads, and circular components. A solid black horizontal band runs across the middle of the image, serving as a backdrop for the title text.

Antenna Measurement Using WSPR

An Involuntary Case Study..

CARA WSPR Presentation 2023



<https://www.youtube.com/watch?v=Jo1xVfZ6fm8&list=PL6xEFYSFi2Mv3GcZDSxelKEsT-fJsng&index=6&t=8s>

Objective: Comparing Antenna Performance

- **Measure SNR and Qualify Results**
- **Use of WSPR as a Means to an End!**
- (1) Use Current 6BTV For Transmit
- (2) Add a dedicated RX Antenna System to improve SNR
 - Loops and Active Verticals - Switchable
 - NCC-2 Phaser

What is WSPR ?

- WSPR uses very low-power transmissions to send and receive signals across long distances, often in conditions where traditional communication would fail. These transmissions are decoded by software and uploaded to a global network, allowing users to visualize and study signal paths and propagation effects in real-time

How Does WSPR Work?

- Hams transmit WSPR signals - no answer is expected.
- Other stations receive it and decode the data, which includes information like the call sign, location, power level, and more. This data is uploaded to a central database where hams can analyze how their signals propagate worldwide

WSPR Modes – Transmit

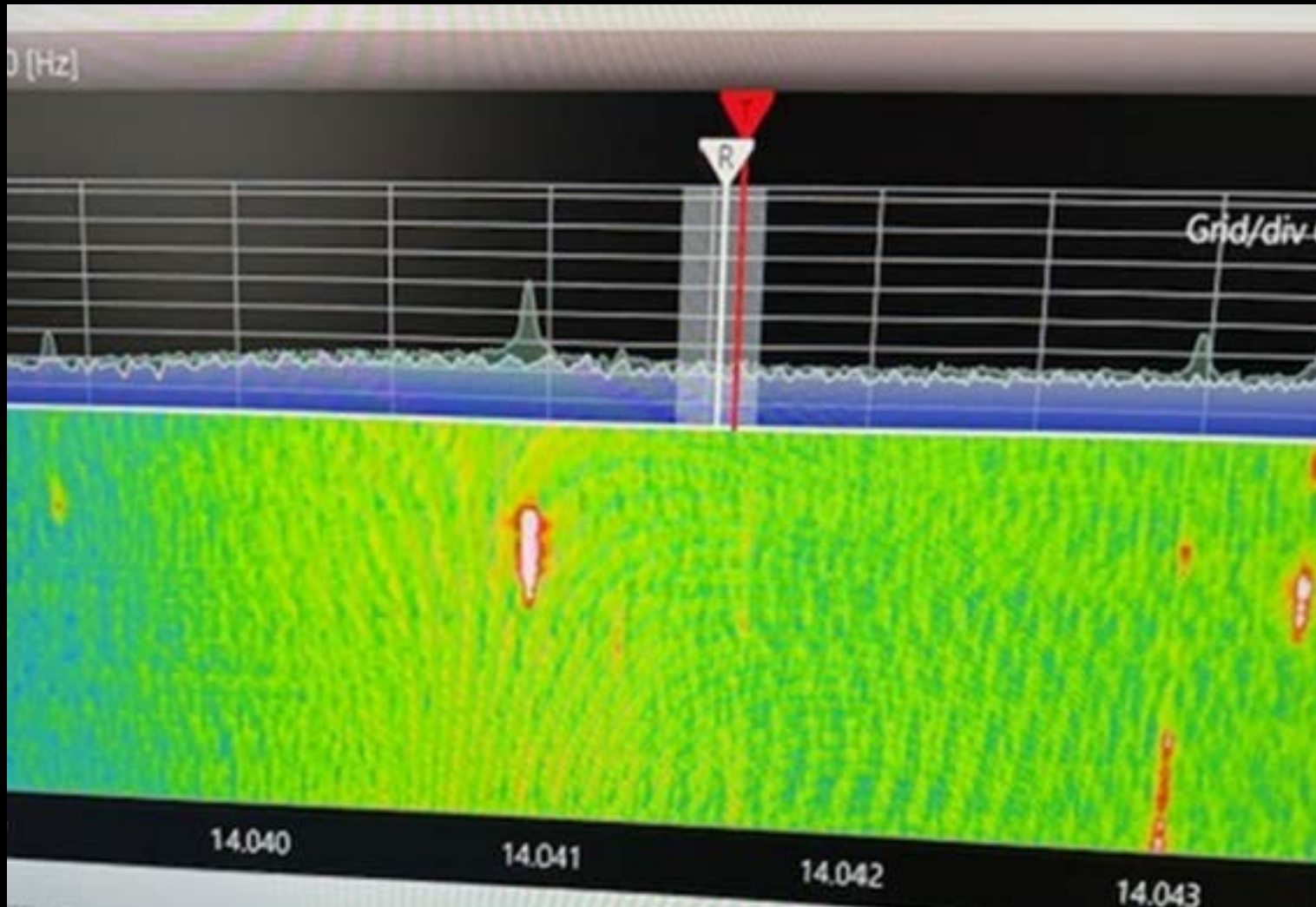
- Test your TRANSMIT antenna effectiveness. See where and how well you are heard around the world.
- Perfect Tool to Test Transmit Antennas
- Useful For Other Stations to Test Receive Antennas or Propagation

WSPR Modes – Receive

- Test your RECEIVE antenna (and/or Radio) effectiveness. See what stations around the world you can hear and how well (SNR)
- Perfect Tool to Test Receive Antennas
- Access data anytime - Continuously stored in the WSPRNet database since 2008
- My Objective: Improve SNR over that of my TRANSMIT Antenna (When used in Receive Mode) Use WSPR to MEASURE SNR Improvement of my new RX Phased Antenna System

Fighting QRN – where It All started...

- CQWVWX CW Contest November 2024



Antenna Testing: A WSPR Application

- Propagation Reporting
- Real World Antenna Analysis Tool
- Take the Guesswork out of Antenna Evaluation – **SNR Measuring**

What's all this SNR stuff anyhow?*

- Signal-to-Noise RATIO (SNR) is a measure used to quantify the quality of a signal in relation to the background noise. It's essentially the ratio of the power or intensity of the desired signal to that of the noise, expressed in decibels (dB)

A higher SNR indicates a cleaner, clearer signal with less interference from noise, while a lower SNR means the noise is more dominant, making the signal harder to distinguish – if at all!

*Tribute to Bob Pease

WSJT-X In WSPR Mode (Receive)

Column of Interest

WSJT-X v2.7.0 by K1JT et al.

File Configurations View Mode Decode Save Tools Help

UTC	dB	DT	Freq	Drift	Call	Grid	dBm	mi
1914	-27	1.2	14.097129	0	AK1WI	FN42	33	2098
1914	-16	0.2	14.097149	0	NM7J	DM26	23	1011
1914	-13	0.3	14.097180	0	N5WNE	DM59	23	841
1914	-25	0.1	14.097191	0	N4SZ	EM85	23	1883
----- 20m -----								
1916	-25	0.1	14.096993	-1	KF9KV	EN52	30	1324
1916	-26	0.1	14.097018	0	KD6RC	CM88	23	972
1916	-28	-0.0	14.097026	1	KI5JWS	EM15	23	1376
1916	-25	0.3	14.097042	-1	N5JUJ	EM32	23	1674
1916	-9	0.7	14.097058	0	WW0WWV	DN70	30	855
1916	-9	0.2	14.097068	0	AJ8S	EM89	37	1699
1916	-25	0.1	14.097074	-1	KI5MQY	EM13	33	1493
1916	-16	-0.0	14.097102	0	N0RZW	EM48	37	1423
1916	-14	0.0	14.097102	0	AC0MM	DM67	20	1004
1916	-25	1.0	14.097108	0	NI5F	EM70	37	2063
1916	-30	-0.1	14.097113	0	KH2R	FN21	23	1961
1916	-22	0.1	14.097128	0	WB6YRW	CM97	23	999
1916	-23	0.1	14.097170	-3	WB0OEW	DM42	33	1295

Stop Monitor Erase Decode Enable Tx Halt Tx Tune ☒ Menus

20m **14.095 600**

H FT8 FT4 MSK Q65 JT65

2025 Mar 18 19:19:32

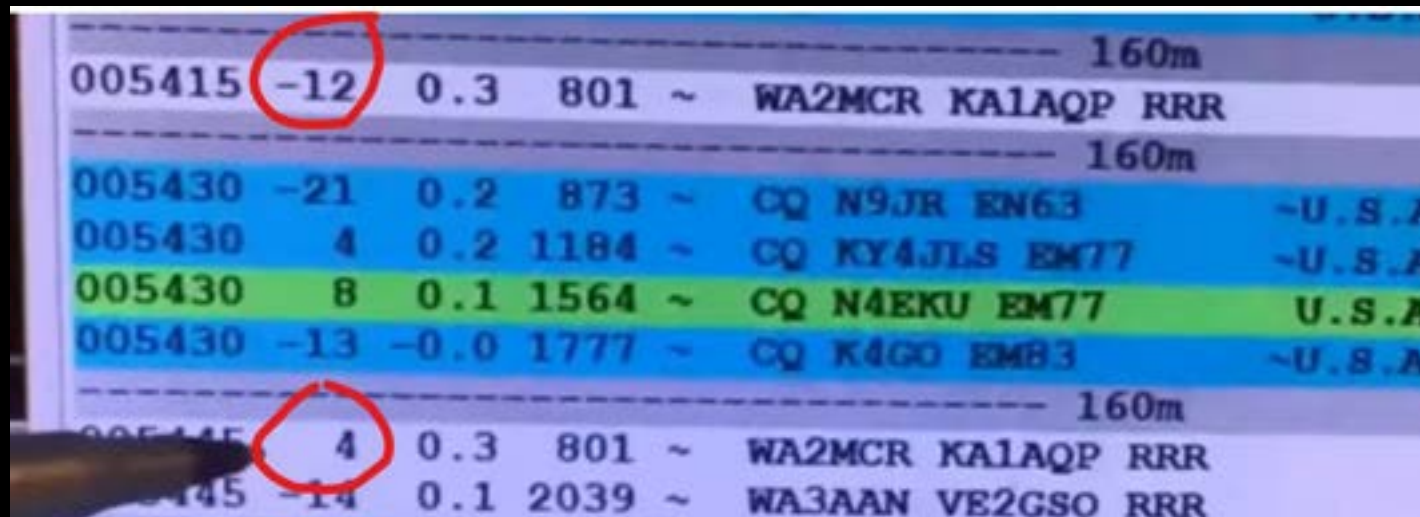
☐ Tx 1500 Hz ☒ Upload spots
☐ Tx Pct 20 % ☒ Prefer Type 1 messages
☐ Band Hopping ☐ No own call decodes

Schedule ... Tx Next 37 dBm 5 W

Receiving WSPR 13 92/120

Improving SNR - Example

- If you can't measure it, you can't improve it.
- How to measure SNR? -> Use WSPR
- Example: <https://www.youtube.com/watch?v=amANwm4PqEI>



005415	-12	0.3	801	~	WA2MCR KA1AQP RRR	160m
005430	-21	0.2	873	~	CQ N9JR EN63	~U.S.A
005430	4	0.2	1184	~	CQ KY4JLS EM77	~U.S.A
005430	8	0.1	1564	~	CQ N4EKU EM77	U.S.A
005430	-13	-0.0	1777	~	CQ K4GO EM83	~U.S.A
005445	4	0.3	801	~	WA2MCR KA1AQP RRR	160m
005445	-14	0.1	2039	~	WA3AAN VE2GSO RRR	

WSPR Raw Data (wspr.vk7jj.com)

wspr.vk7jj.com

[220 spots] 219 to 0
wspr.live search time was 0.044443629 secs

Table options find duplicates Saved searches

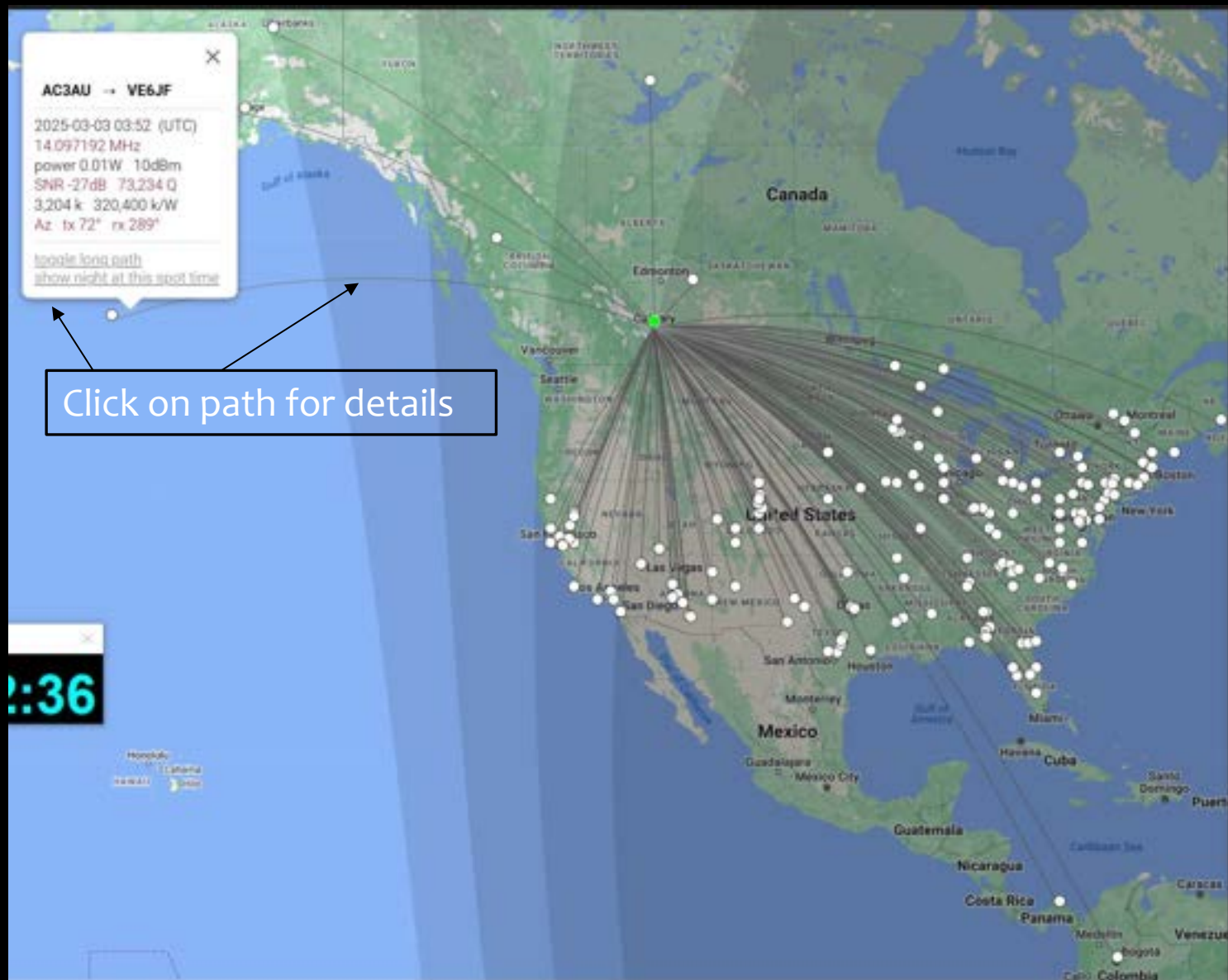
Click on MAP to Visualize Data

help SQL charts map table search

▲ status -> locator RQ00eg, LST 15:01
** Click table cells for more info. **

y-m-d	local	txCall	txGrid	rxCall	rxGrid	MHz	W	SNR	drift	k	txAz°	mode	k/W	spotQ	version
2025-02-27	20:12	K8CHY	EM72gn	VE6JF	D021wd	18.106002	1	-18	0	3112	320	WSPR2	3112	1512	2.7.0
2025-02-27	20:08	K8CHY	EM72gn	VE6JF	D021wd	18.106002	1	-18	0	3112	320	WSPR2	3112	1512	2.7.0
2025-02-27	20:06	NI5F	EM70fu	VE6JF	D021wd	18.106111	5	-27	0	3255	322	WSPR2	651	149	2.7.0
2025-02-27	20:00	W4MGA	FM17	VE6JF	D021wd	18.106022	0.2	-27	0	3272	310	WSPR2	16360	3739	2.7.0
2025-02-27	19:56	NI5F	EM70fu	VE6JF	D021wd	18.106112	5	-26	0	3255	322	WSPR2	651	167	2.7.0
2025-02-27	19:52	K8CHY	EM72gn	VE6JF	D021wd	18.106002	1	-26	0	3112	320	WSPR2	3112	800	2.7.0
2025-02-27	19:40	N5XXN/Z	DM81ru	VE6JF	D021wd	18.106128	0.2	-21	0	2345	340	WSPR2	11725	4690	2.7.0
2025-02-27	19:38	N5XXN/Z	DM81ru	VE6JF	D021wd	18.106128	0.2	-21	-2	2345	340	WSPR2	11725	4690	2.7.0
2025-02-27	19:38	AD8IO	EN81uf	VE6JF	D021wd	18.10609	0.2	-24	0	2660	305	WSPR2	13300	4180	2.7.0
2025-02-27	19:32	N5XXN	DM81ru	VE6JF	D021wd	18.106205	0.2	-30	0	2345	340	WSPR2	11725	1675	2.7.0
2025-02-27	19:32	W8RBW	EN72qr	VE6JF	D021wd	18.106103	0.2	-20	0	2407	303	WSPR2	12035	5158	2.7.0
2025-02-27	19:22	K8EB	EN73cb	VE6JF	D021wd	18.10602	0.2	-14	0	2307	303	WSPR2	11535	6921	2.7.0
2025-02-27	19:22	AG5ZN	EM12ou	VE6JF	D021wd	18.106013	0.2	-25	0	2474	330	WSPR2	12370	3534	2.7.0
2025-02-27	19:14	AD8IO	EN81uf	VE6JF	D021wd	18.106123	0.2	-28	0	2660	305	WSPR2	13300	2660	2.7.0

WSPR Balloon AC3AU 10mW



Import WSPR Data to Excel

Convert SNR dB to linear value

$$= 10^{(K5/10)}$$

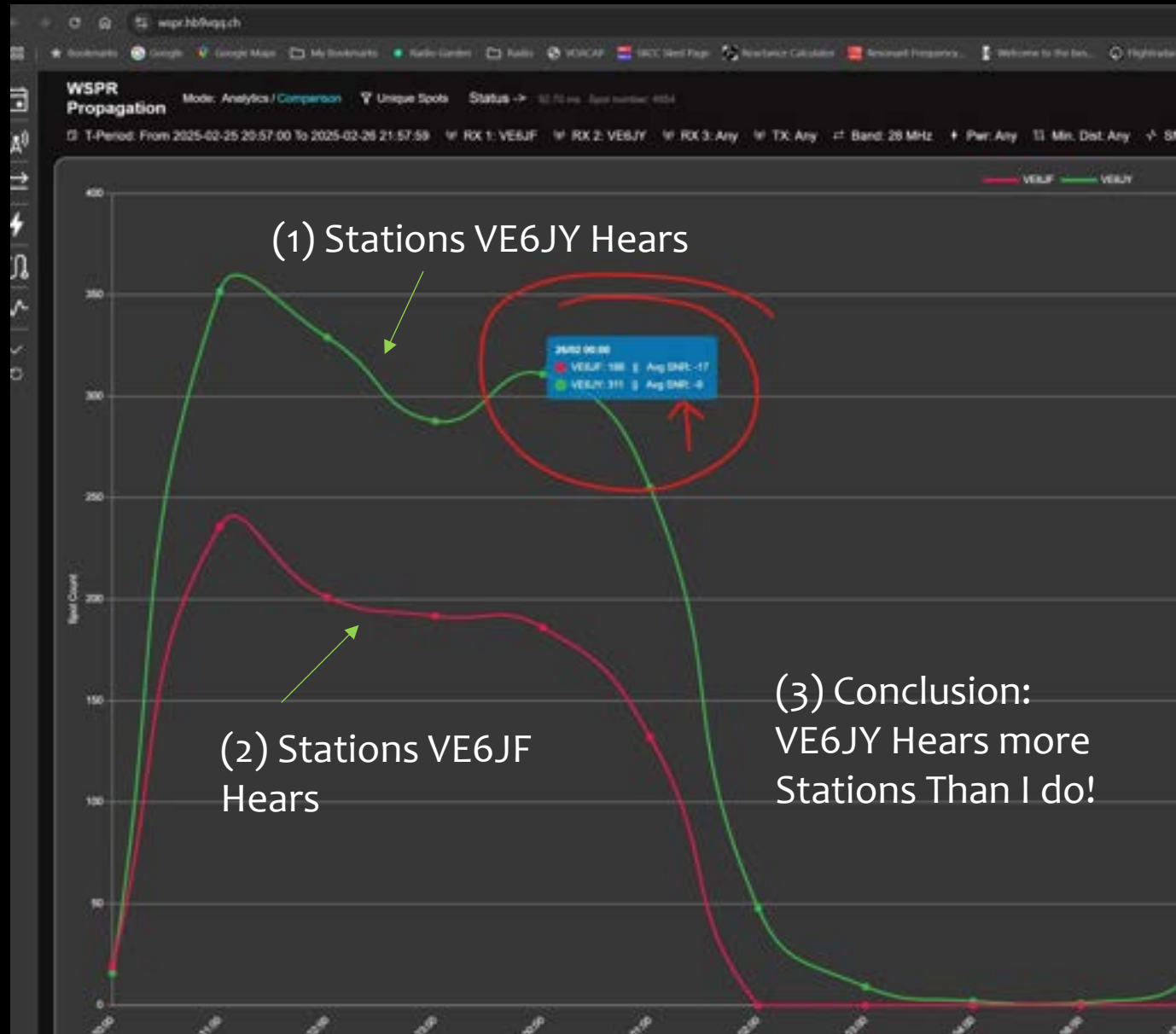
spotnum	date (y-m-d)	txCall	txGrid	rxCall	rxGrid	MHz	Watts	SNR	drft	k	az	mode	k/W	spotQ	version	SNR Linear Values
218	2025-03-06 20:14	WW0WWV	DN70mq	VE6JF	DO21wd	14.09706	1	-3	0	1360	332	WSPR2	1360	1243	2.7.0	0.501187234
213	2025-03-06 20:14	G4HSB	IO94	VE6JF	DO21wd	14.09716	0.2	-23	0	6738	319	WSPR2	33690	11551	2.7.0	0.005011872
210	2025-03-06 20:14	WQ4M	FM19	VE6JF	DO21wd	14.0972	0.2	-30	0	3134	307	WSPR2	15670	2239	2.7.0	0.001
212	2025-03-06 20:14	N9OTG	EM36	VE6JF	DO21wd	14.09714	0.2	-22	0	2334	321	WSPR2	11670	4335	2.7.0	0.006309573
211	2025-03-06 20:14	K0UO	EM07	VE6JF	DO21wd	14.09718	0.2	-16	0	1928	327	WSPR2	9640	5233	2.7.0	0.025118864
216	2025-03-06 20:14	K0CFW	EN34oq	VE6JF	DO21wd	14.09719	0.2	-13	0	1736	302	WSPR2	8680	5456	2.7.0	0.050118723
219	2025-03-06 20:14	N0UDM	DM78	VE6JF	DO21wd	14.09705	0.2	-15	0	1577	336	WSPR2	7885	4506	2.7.0	0.031622777
217	2025-03-06 20:14	WA7LNW	DM37gd	VE6JF	DO21wd	14.09708	0.2	-22	0	1558	358	WSPR2	7790	2893	2.7.0	0.006309573
215	2025-03-06 20:14	AC0MM	DM67	VE6JF	DO21wd	14.09711	0.1	-22	0	1619	342	WSPR2	16190	6013	2.7.0	0.006309573
214	2025-03-06 20:14	KG6VGL	CM99	VE6JF	DO21wd	14.09718	0.1	-14	0	1404	20	WSPR2	14040	8424	2.7.0	0.039810717
220	2025-03-06 20:14	N6RJH	DN13tp	VE6JF	DO21wd	14.09704	0.001	-27	0	851	11	WSPR2	851000	194514	2.7.0	0.001995262
205	2025-03-06 20:16	N15F	EM70fu	VE6JF	DO21wd	14.09711	5	-14	0	3255	322	WSPR2	651	391	2.7.0	0.039810717
196	2025-03-06 20:16	N0RZW	EM48	VE6JF	DO21wd	14.09713	5	-22	0	2285	316	WSPR2	457	170	2.7.0	0.006309573
209	2025-03-06 20:16	VA7PP	CN88hm	VE6JF	DO21wd	14.097	5	-27	0	724	63	WSPR2	145	33	2.7.0	0.001995262

Calculate Average and Convert SNR back to dB value

$$=10*\text{LOG10}(T227)$$

SNR	0.068404988
dB avg	-11.64912229

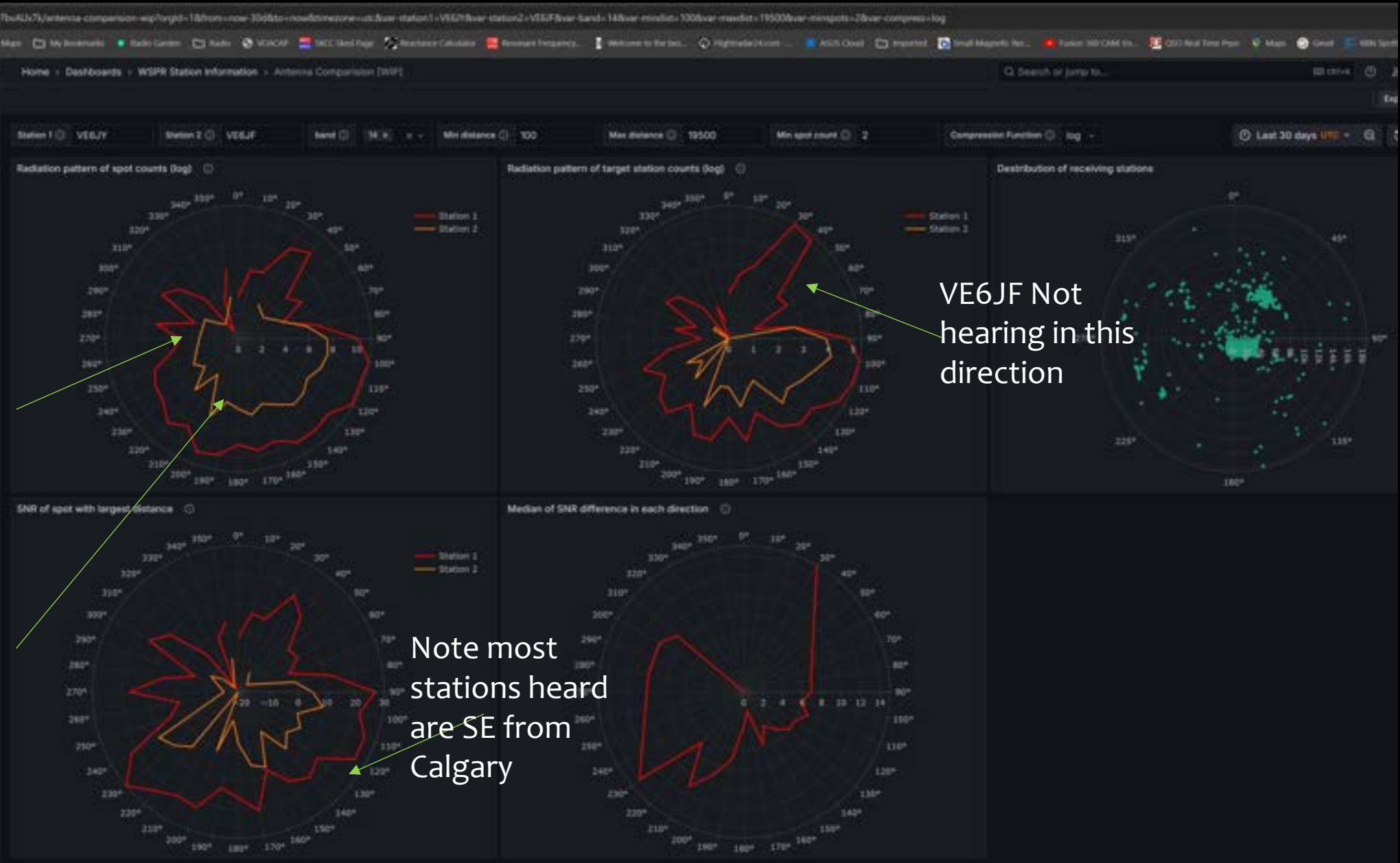
Measuring Antenna Improvement (wspr.hb9vqq.ch)



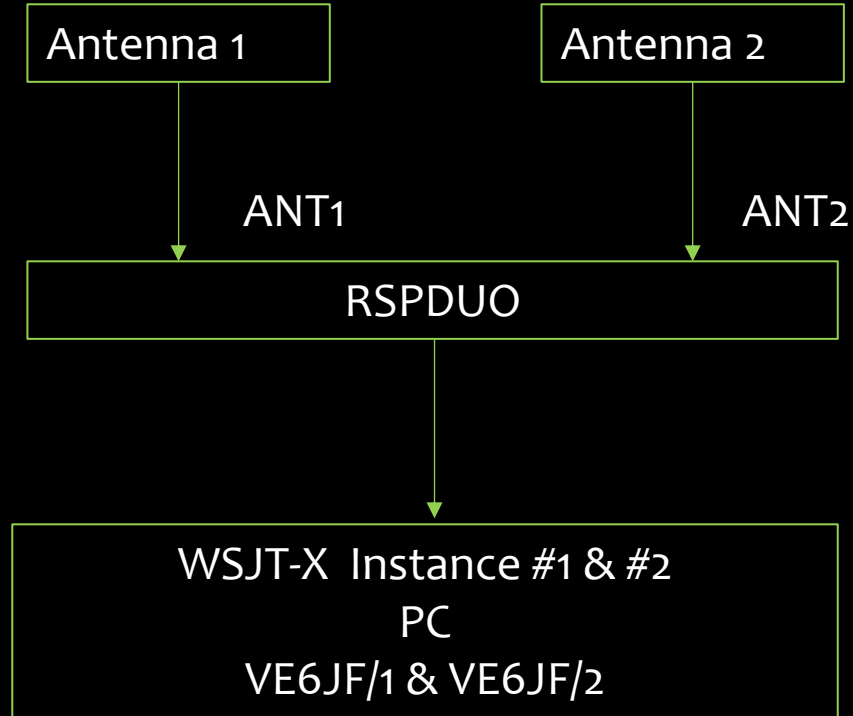
Measuring Antenna Performance (wspr.live)

VE6JY
hears
stations
to this
distance

VE6JF
hears
stations
to this
distance

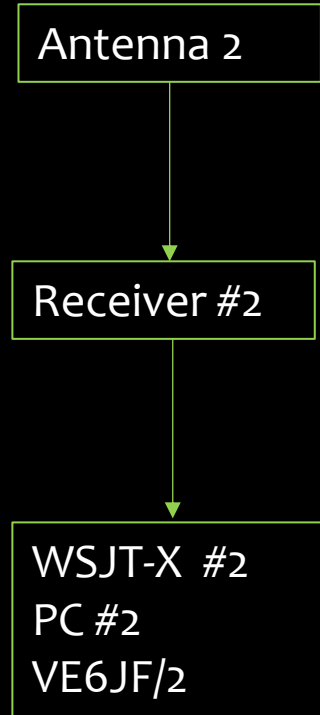
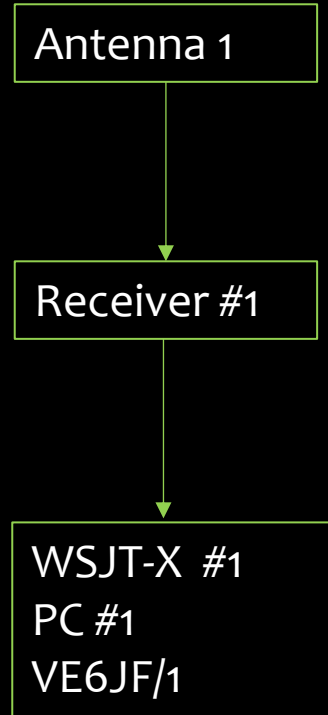


Antenna Measurement – Configuration #0



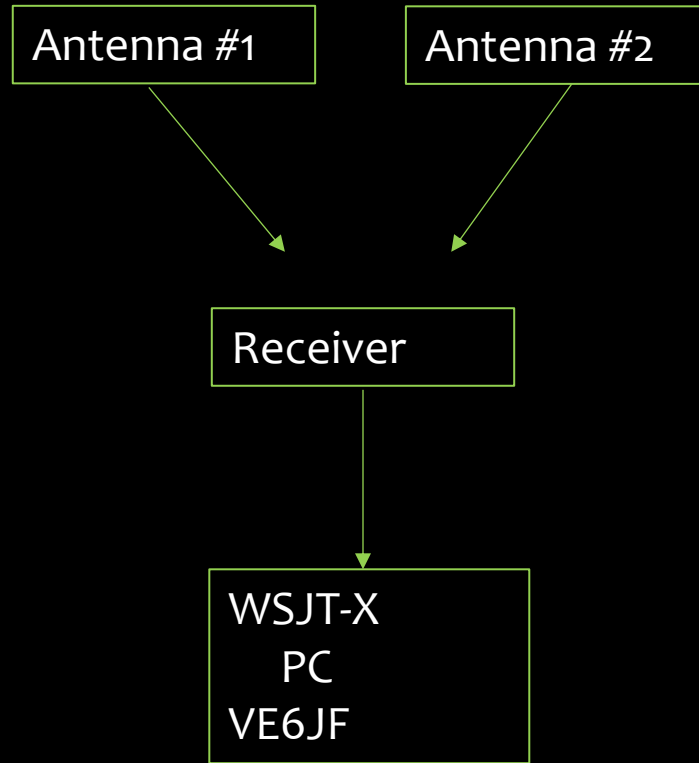
Allows 2 instances to run concurrently. Best Possible configuration. Fewer variables.

Antenna Measurement – Configuration #1



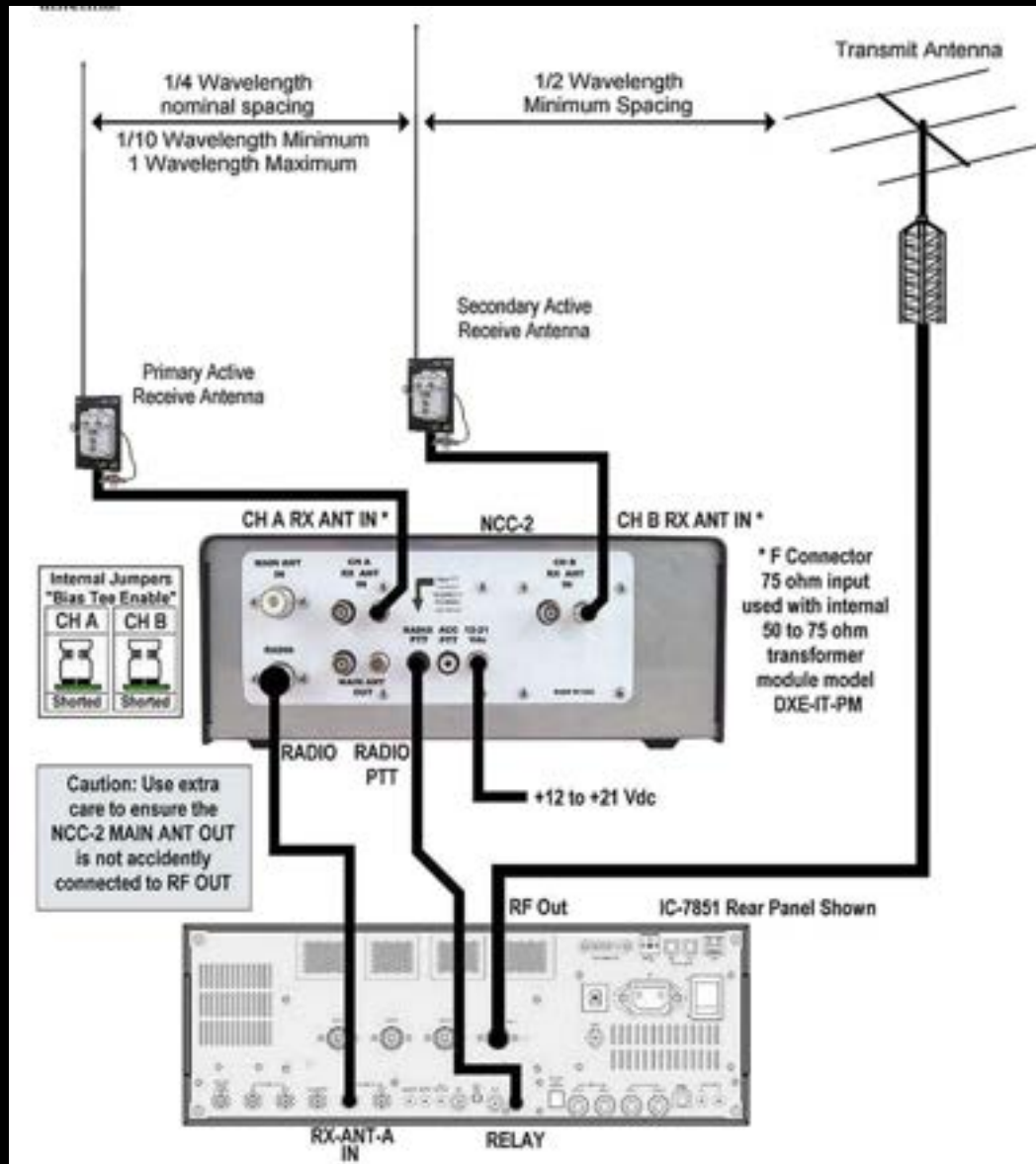
Allows 2 instances to run concurrently. Assumes Receiver specs identical.

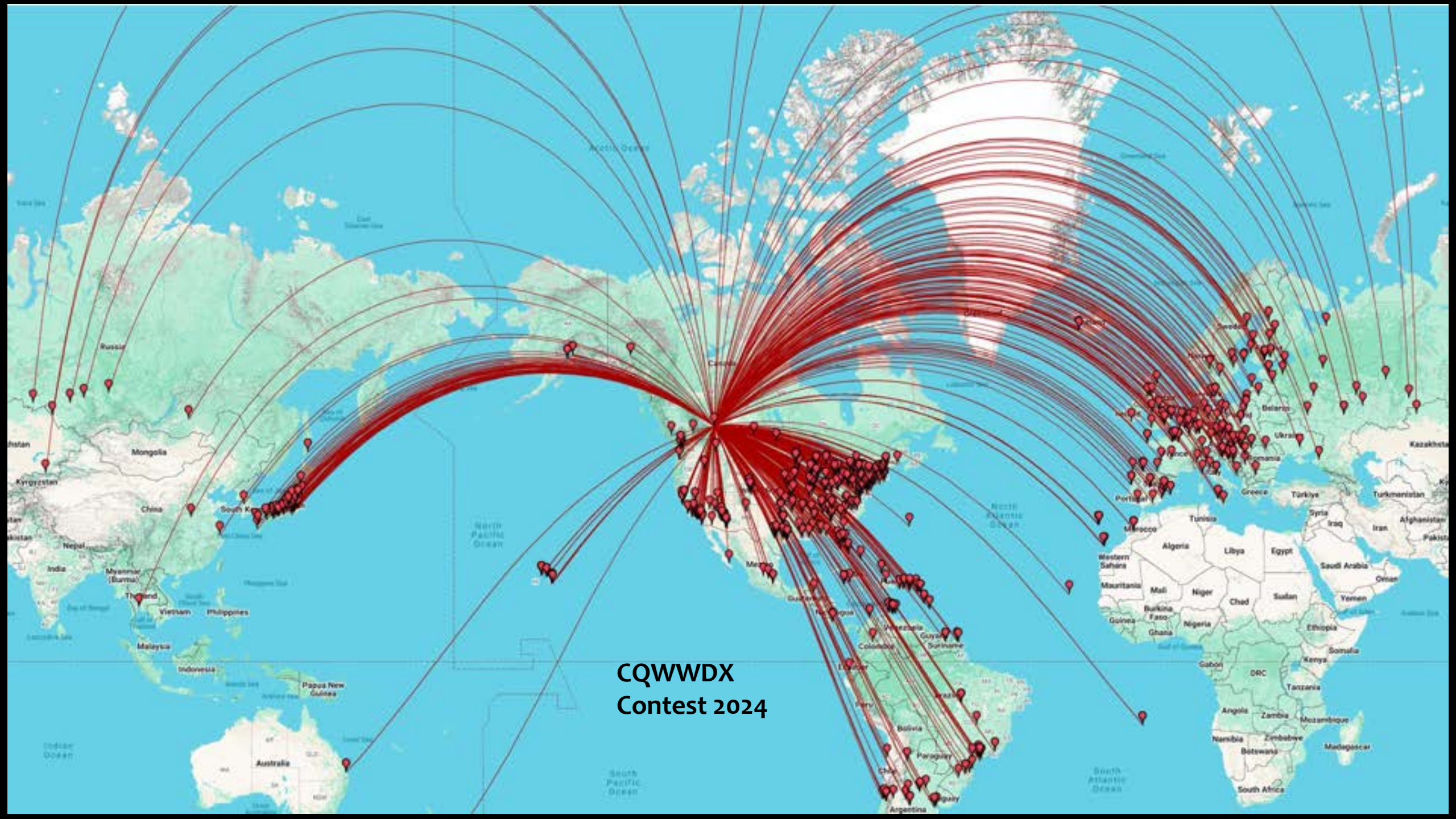
Antenna Measurement – Configuration #2



Only 1 instance. Requires manually alternating antennas after a test period. Some inaccuracy due to changing propagation. May be minimized by running WSPR for short periods. Eg 10 minutes

Phased Receive Antennas





CQWWDX
Contest 2024



The end....

Questions?

Bob Pease - His actual desk!