

Propagation Study of 15m QRP
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This project is modelled after work that I did in 1995 while living in Dallas TX. At that time I had the old call K5FO. Phyllis and I lived near White Rock Lake on the NE side of downtown Dallas. The home was surrounded by old and tall pecan trees. The trees kept things cool in the hot summers and provided some shelter during the winter months. But it was a lousy scenario for antennas. Not wishing to be QRT I went ahead put up an off-center fed dipole. Off center means that the feedpoint is not at the center of the dipole and I was using 300 ohm impedance window line. See photo later for the 300 ohm window line that I used and still use. Bought a large quantity over 20 years ago from the Wire-Man at a swapmeet in TX. The antenna was only 5 meters off the ground, between two pecan trees and surrounded by other trees. Managed to get all 50 states on 30m in a few years using only 950 milliwatts of power output from a Small Wonder Labs 30m transceiver using battery power. It just doesn't get any better than that.

In order to show you how minimal that project was and still is I will describe in gory detail just how I do things as show-and-tell for this project. This is not for the purpose of getting you to do it my way, but to get you off your butt and on the air also. There are so many radio amateurs in this Internet age that are too dependent upon the Internet for entertainment and information that a lot of us are just not getting on the air like we used to. Been there. Done that. Got the T-shirt to prove it.

There is one more important reason why a human being would go through all this trouble to write up a project. It is solely for the purpose of getting everything in one place. We tend to spread things around in notebooks, papers, books, and other stuff. It helps gain a prespective and possibly new insight into something in our environment that we just haven't had the time to pursue in our lives. So. Let's begin the journey. You are certainly welcome to come along.

Making Contacts

I have an old old habit, started in 1957 as a Novice (KN5FJZ), that I still continue today. Call it OCD if you want but I find that it works for me. I copy code with a pen and paper at all speeds up to 40WPM and sometimes higher. At the station desk, I have a spiral notebook or loose sheets of plain writing paper or unbound notebook paper. I also use a rolling ball pen of some type. I prefer medium or even a broad width, but will use a fine tip on occasions. I want a pen that moves smoothly as possible. I find that I can write faster and it is less tiring on the hand and wrist. You have to experiment with combinations and find one that works for you. Every one has their own secret recipe.

While tuning around the band, I will jot down calls and even copy a QSO in progress to see if there some interesting callsigns to be heard. Also gets me warmed up for copying CW. I'll sometimes write down the time (UTC), day of the week and frequency for later reference. If a station is carrying on a long QSO I can get some idea of their usual operating times for trying to work them later. This works especially well if the person has a regular schedule with another amateur or even a family member.

When I start to work a station, I will write down on the page the time, date, frequency, the rig I'm using, power output level, and other stuff that I want to put into the logbook. And I write down everything that I copy off the air during the QSO. I have a number of notebooks of almost every QSO that I have made since 1970. I had everything before that at one time, but it was thrown out by some one not knowing what it was or just how valuable it was. Be sure to write down the ending time when you finish the QSO. It helps just to see how much you are on the air and how long the good QSOs can get. The "hit and run" QSO guys I avoid afterwards if they are just making QSOs to rack up a count of some numbers they are collecting or whatever. The art of conversation is dying, to say the least. I also keep the code speed for statistical analysis later on just to see how the speeds are averaging year to year. I can tell you that they are going down.

I may even use the logbook sheet shown on the next page. The page

is reduced in size. The full size sheet in PDF format is on my web page for your use. This sheet keeps me from missing information that I want to put in my permanent logbook on the computer. Oh you say. Yes, I back things up so that I won't miss data if the system crashes. I keep the paper until I do the next backup. Then I might recycle it.

Permanent Logbook

I have a permanent logbook on the computer. It is in ASCII and starts with the complicated looking format shown below. I have been using UNIX and Linux so long that I don't use other programs. Guess it is a case of growing up having to and wanting to build everthing from scratch. Not a philospthy that many individuals can fully comprehend or even want to try. No problem.

The lines that start with an asterisk are continuations of the line above and should be removed and appended to the line above.

```
.ps 8
.vs 9
.nf
.ft CW
.sp |5
.TS
tab(:),center, box;
cw(8)2 | cw(5)2 | cw(4)2 | lw(8) | cw(3)2 | cw(3)2 | cw(4) | cw(2)2
*
| cw(3)2 | cw(30) | cw(2)2 | cw(3)2
cw(8)2 | cw(5)2 | cw(4)2 | lw(8) | cw(3)2 | cw(3)2 | cw(4) | cw(2)2
*
| cw(3)2 | cw(30) | cw(2)2 | cw(3)2
1 | c | 1 | 1 | 1 | 1 | 1 | 1 | c | 1 | 1 | 1.
DATE:START:END:STATION:HIS:MY:FREQ:CW:PWR:COMMENTS:WPM:QSL
:::RST:RST:::::S/R
-
.sp
19990921:0341:0348:AA5TB/QRP:559:549:10.115:CW:1:Steve - Ft Worth,TX:
*
20:::dsw-30 lw battery 1st qso de az
19990921:0413:0427:AC6RN/QRP:599:579: 7.041:CW:1:Kory - ,CA:
*
20:::dsw-40 to dsw-40 2x 2w
19990921:0439:0447:WE6W/QRP:579:339: 7.040:CW:1:Ed - ,CA:
*
20::: dsw-40 lw his 3w tentec es loop
19990921:0457:0506:W6ZOH/QRP:559:549: 7.029:CW:1:Floyd - boise,ID:
*
20:::
19990921:1510:1519:K7NA:599:549: 7.030:CW:1:Vince - Carlsbad,CA:
*
22::: dsw-40 lw his 5w tentec omni 80m zepp
```

I use two programs tbl and groff to generate the following page.

tbl k7qo | groff -Tps > k7qo.ps

DATE	START	END	STATION	HIS RST	MY RST	FREQ	CW	PWR	COMMENTS	WPM	QSL S/R
19990921	0341	0348	AA5TB/QRP	559	549	10.115	CW	1	Steve - Ft Worth,TX	20	
19990921	0413	0427	AC6RN/QRP	599	579	7.041	CW	1	Kory - ,CA	20	
19990921	0439	0447	W6GW/QRP	579	339	7.040	CW	1	Ed - ,CA	20	
19990921	0457	0506	W6ZOH/QRP	559	549	7.029	CW	1	Floyd - boise, ID	20	
19990921	1510	1519	K7NA	599	549	7.030	CW	1	Vince - Carlsbad, CA	22	
19991020	2218	2227	KA9DVS	599	570	18.084	CW	1	Dennis - Genoa, IL	20	
19991020	2310	2320	K0EVZ/QRP	599	569	14.060	CW	2	Doc - Bismarck, ND	22	
19991030	0110	0110	AC6KN/QRP	599	559	14.059	CW	0.8	Jeff - ,CA	22	
19991030	0113	0113	AE4IC/QRP	559	599	14.061	CW	0.8	Elvis - ,NC	22	
19991030	0116	0116	K5LN/QRP	599	559	14.059	CW	0.8	Bill - ,TX	22	
19991030	0118	0118	K7PD/QRP	599	579	14.062	CW	0.8	John - ,OR	22	
19991030	0127	0127	VE3VAW/QRP	599	599	14.062	CW	0.8	Elvis - ,ONT	22	
19991030	0131	0131	W7ILW/QRP	559	559	14.062	CW	0.8	Howard - Prescott, AZ	22	
19991030	0135	0135	W3KC/QRP	589	569	14.058	CW	0.8	Chas - ,MD	22	
19991030	0137	0137	WA3WSJ/QRP	559	539	14.058	CW	0.8	Ed - ,PA	22	
19991030	0139	0139	AC5K/QRP	559	599	14.057	CW	0.8	Wes - ,TX	22	
19991030	0153	0153	W5JAY/QRP	599	599	14.060	CW	0.8	Jay - ,AR	22	
19991030	0200	0200	N4ROA/QRP	599	559	14.057	CW	0.8	Elvis - ,VA	22	
19991030	0213	0213	N9AW/QRP	599	559	14.060	CW	0.8	Jerry - ,WI	22	
19991030	0237	0237	NW7DX/JR	569	559	14.063	CW	0.8	Ben - ,WA	35	
19991030	0243	0243	N8IE/QRP	569	549	14.060	CW	0.8	Dan - ,OH	28	
19991106	1755	1805	KB9IUA/0	599	559	28.061	CW	1.0	Kevin - ,IA	20	
19991106	1901	1906	W4EEX	589	449	28.059	CW	1	Sara - Louisville, KY	20	
19991227	0347	0355	N5JI/QRP	559	339	7.043	CW	0.9	Dick - Dallas, TX	30	
20000813	2001	2001	NW7DX	559	559	14.060	CW	0.1	WA Ben 1892	30	
20000813	2002	2002	K0EVZ	559	559	14.060	CW	0.1	ND Doc 861	30	
20000813	2003	2003	VE7SL	559	449	14.060	CW	0.1	BC Steve 769	30	
20000813	2004	2004	AE9F	559	559	14.060	CW	0.1	CA Dan 5W	30	
20000813	2006	2006	AF5Z	559	579	14.060	CW	0.1	TX Bob 984	30	
20000813	2007	2007	N5GLQ	559	559	14.060	CW	0.1	LA Mike 5W	30	
20000813	2008	2008	VA6RF	559	559	14.060	CW	0.1	AB Earl 1076	30	
20000813	2010	2010	KW7D	559	569	14.060	CW	0.1	NV Paul 5W	30	
20000813	2010	2010	N6WG	559	539	14.060	CW	0.1	CA Bob 26	30	
20000813	2012	2012	K7TQ	559	559	14.060	CW	0.2	ID Randy 102	30	
20000813	2016	2016	W1LR	559	559	14.060	CW	0.2	CO Larry 2137	30	
20000813	2017	2017	K7TQ	559	559	14.060	CW	0.2	ID Randy 102	30	
20000813	2018	2018	N4ROA	559	229	14.060	CW	0.5	VA Dan 970	30	
20000813	2019	2019	W7ILW	559	559	14.060	CW	0.5	AZ Howard 2010	25	
20000813	2020	2020	K5TR	559	559	14.060	CW	0.5	TX Geo 5W	25	
20000813	2022	2022	K5AAR	559	559	14.060	CW	0.5	OK Don 1512	25	
20000813	2023	2023	N0UR	559	229	14.060	CW	0.5	MN Jim 799	25	
20000813	2025	2025	WA7SPY	559	559	14.060	CW	0.5	OR Glen 2214	25	
20000813	2025	2025	W5YR	559	559	14.060	CW	0.5	TX Geo 1373	25	
20000813	2028	2028	K9IUA	559	559	14.060	CW	1.0	ND Kevin 384	25	
20000813	2030	2030	KU7Y	559	559	14.060	CW	1.0	NV Ron 17	25	
20000813	2032	2032	WA7SPY	559	559	14.060	CW	1.0	OR Glen 2214	25	
20000813	2033	2033	AA5UN	559	459	14.060	CW	1.0	TX Marty 5W	25	
20000813	2034	2034	N1FN	559	559	14.060	CW	1.0	CO ET 163	25	
20000813	2040	2040	K5LN	599	559	14.060	CW	1.0	TX Bill 1794	25	
20000813	2041	2041	N5TW	559	559	14.060	CW	1.0	TX Tom 1474	25	
20000813	2042	2042	AJ4Y	559	449	14.060	CW	1.0	FL Paul 1795	25	
20000813	2051	2051	VE5RC	559	119	14.060	CW	1.0	SK Bruce 886	25	
20000813	2054	2054	N7CQR	559	559	14.060	CW	1.0	OR Dan 502	25	
20000813	2104	2104	AJ4AY	559	339	14.060	CW	1.5	AL Jay 1795	25	
20000813	2108	2108	NM5M	559	559	14.060	CW	1.5	TX Eric 1824	25	
20000813	2110	2110	W7ILW	559	559	14.060	CW	1.5	Howard - Prescott, AZ	25	
20010112	1832	1854	KB7ZO	599	579	10.118	CW	0.5	Bob - Meridian, ID	20	S/R
20010113	0229	0234	AC5XK	579	559	10.118	CW	0.5	Don - San Antonio, TX	20	S/R
20010113	0236	1244	WD5HP1	449	439	10.112	CW	0.5	Jim - Slidell, LA	20	S/R
20010113	2110	2120	WA6SNJ/QRP	599	599	10.118	CW	0.5	Dave - Omaha, NE	20	S/R
20010113	2121	2128	W9UQB/QRP	579	559	10.118	CW	0.5	Mike - Phoenix, AZ	20	S/R
20010113	2145	2159	W5ZF/QRP	599	599	10.118	CW	0.5	Stan - Albuquerque, NM	22	S/
20010113	2135	2145	K7DU	599	449	10.118	CW	0.5	Geo - Hanna, WY	20	S/R
20010113	2245	2250	XE2BSS	599	559	10.111	CW	0.5	Alex - Mexico	20	
20010113	2250	2301	WA6RND	599	59	10.111	CW	0.5	John - Orange, CA	22	S/
20010113	2301	2305	KI6SN/QRP	559	579	10.111	CW	0.5	Rich - Riverside, CA	25	S/R
20010113	2329	2357	W6XF/7	599	579	10.109	CW	0.5	Tom - Sun Valley, NV	22	

Data Accumulation

Now comes the hard part. At least it used to be hard to get the great circle path distance from my QTH to the other station's location. But now there are numerous tools on the Internet that other QRPers have created. Just Google for the keywords that occur in what you are looking for. You will note that in the data for the logbook there are comments and additional information beyond the fields that I printed. That is where I keep the distances. I can then use `grep` and `awk` to remove the fields and use them for data analysis for whatever purpose I have in mind.

Station Setup

The station, which I will photograph and put here for documentation purposes, is a Ft Tuthill 15m kit from Dough Hendricks, KI6DS, and his company QRP Kits located in California. It took me almost 6 months to get the kit built due to delays in communications. I am due some parts from Doug, but I haven't seen them, but I know he will eventually get around to it. Not that I don't have enough parts as it is.

I am also in the process of starting the build on a SDR transceiver from Tony Parks and will have it setup for 10-, 15- and 17-meters. Thought I just might try PSK31 and see what the big to-do is all about. Limiting output to two watts and see how the antenna works with the build up of the current sunspot cycle.

And to top that off, I am also modifying a Small Wonder Labs 20m transceiver to work on 15m. That is obviously taking a long time due to trying to get more on the air time and also working on getting organized for the first time ever. Don't know if it is worth it, but let's see.

The plan is to leave the rig on starting at sunrise and all during the day and put the gel-cell back on the charger overnight. The cell is a 12Ahr puppy that is pretty hefty and should do the job for a couple of years. Be a good chance to try looking at longevity of gel-cells in this situation. I will then put the headphones on from time to time and tune 20KHz or so to either side of 21.035MHz to see how the

band is doing. This gets me the QRP watering holes and close to the DX on the low end of the band.

Data Plotting

I thought that instead of using my own plotting routines written in C for the 1995 project that I would use a program that comes with Linux called `gnuplot`. It is available also on other operating systems, since it is open source software (OSS). Here are two test cases using the data from 1995. I don't have the original files from the paper, but I can recreate the data files from the old K5FO logbook.

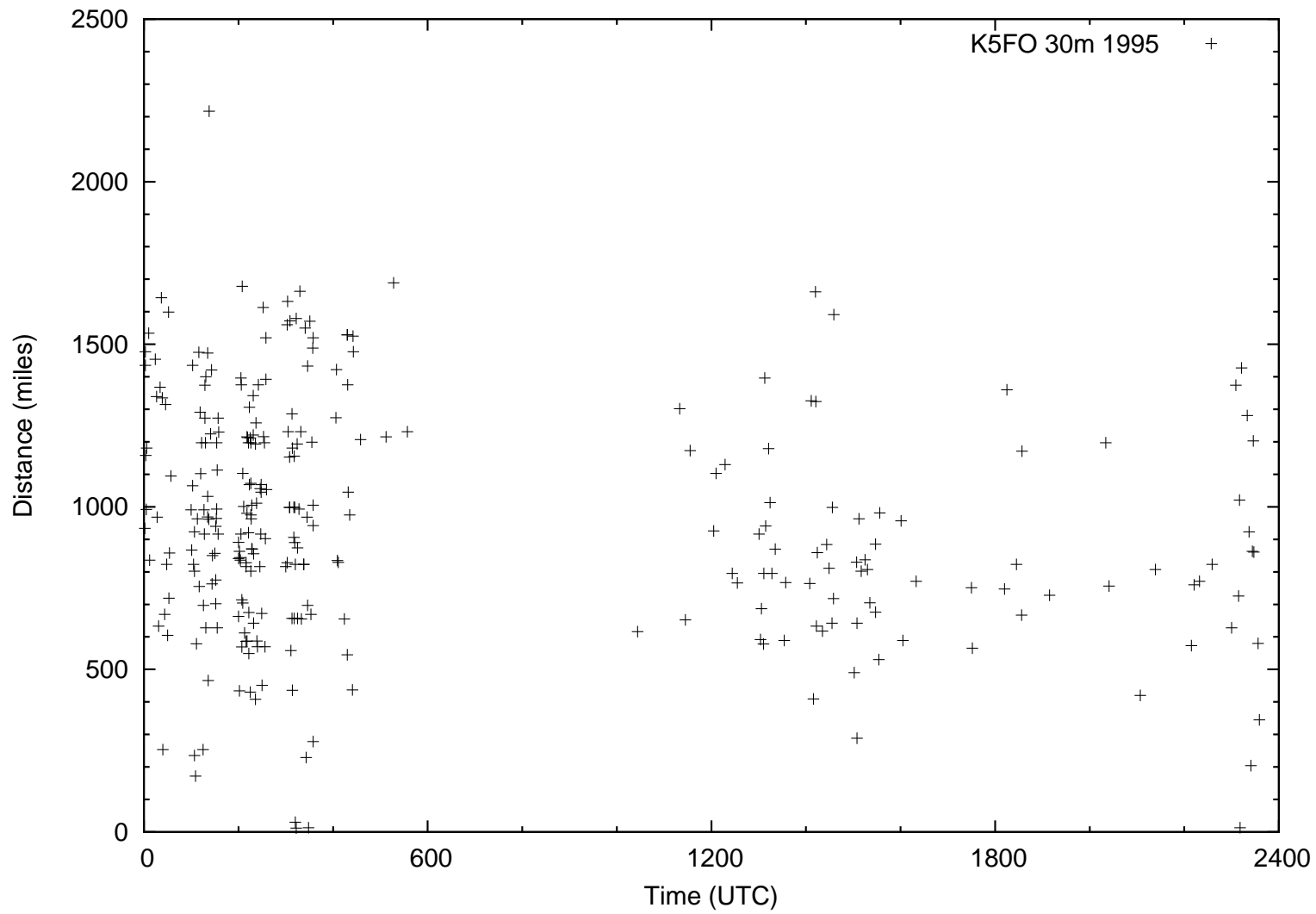
Backups

I have personally been involved with computers for over 46 years. I have seen them evolve from large mainframes that occupied a very large room on a raised floor to force high volumes of cold air to keep them from melting like the wicked witch. I now have an appreciation for the daily and weekly backups of the old days. Now we have easier methods to do backups. I have over 500GB of data, programs and books in digital formats. I don't even want to think about losing everything. So what I do is buy a 500GB or 1TB external USB drive and back things up at regular intervals.

With the cheap internal drives being cheaper than the external that require the hardware support of power supplies, etc. I have purchased a USB docking station that will allow you to plug in an internal drive and then use it for backups. Then you just have to be sure to store the drive in an antistatic cover that it comes in and put it away from areas of danger. Might even be worth the extra trip to the bank and put it in the safety deposit box every other month or so. Get a couple and rotate them. The extra fifty dollars for a drive is worth the peace of mind that comes with knowing that I would never lose a significant amount of the data.

Here is the plot that appeared in the 1995 talk at Dayton. There are a few more contacts plotted, since I didn't separate out the dates for the period of the original paper. The time differential between UTC and CST is 6 hours without daylight savings time, so there are no

corrections to see what was the local time at the time of the QSO. The gap is mainly during midnight to 6am local and since at the time I was still working, either propagation was non-existent or I was sleeping. Working QRP is exhausting.



Distance Calculations

At <http://www.qrparci.org> there is a distance calculator. All you need is your call and the other station's call and it will look up the QTH of both stations and do the great circle calculation. If you feed in your power the application will calculate miles-per-watt for submitting for an award. See the web page for details.

No. Don't do the above. I find that the distance calculations are in error. For some reason QRP ARCI has my address wrong and still in Prescott, even though I have corrected the address in every place known to man. The way to get your distance from your station (keep you FCC license data up to date) to the other is going to QRZ.COM, logging in (it is free when you register) and doing a search on the call in the upper left of the home page. Then go to the details tab and you will see rows of data and one of them is the distance in km. That is the one that I use and it is very accurate and you didn't have to fuss with gathering a lot of data to get it done. It is much appreciated Fred (owner of QRZ.COM).

I use the thirteenth field of the log data file to store the distance. I am about to get away from the old measurements and go to kilometers for the metric system (SI).

Is 15m Open?

There are two ways to determine if there is the possibility of the band being open (a term meaning that communications are possible on 21.000MHz and above in the ham band called 15 meters).

The first is to turn the transceiver on and tune around your favorite part of the band. Mine is the lower 50 KHz. And if I don't hear any stations in a QSO mode or calling CQ, then I will pick a frequency and send QRL? to see if the frequency is in use. I do the QRL? at 20WPM and listen for 10 seconds or so. Why so long? Well, there is the possibility that some one is working another station and can hear me and the other station, but they can't transmit as they are copying the station and don't want to interrupt in quick order. It is your job and your job only to be patient. Don't be in a hurry

and cause bad feelings and make some one mad at you and make your life miserable.

Another way to determine if there is a chance for communications is to go to several online solar propagation monitoring sites and check on the sunspot count, solar flux and the A-index or look for solar flare activity that will make communications very difficult at times. Read up on what the numbers mean. Education and understanding is important. Do your homework.

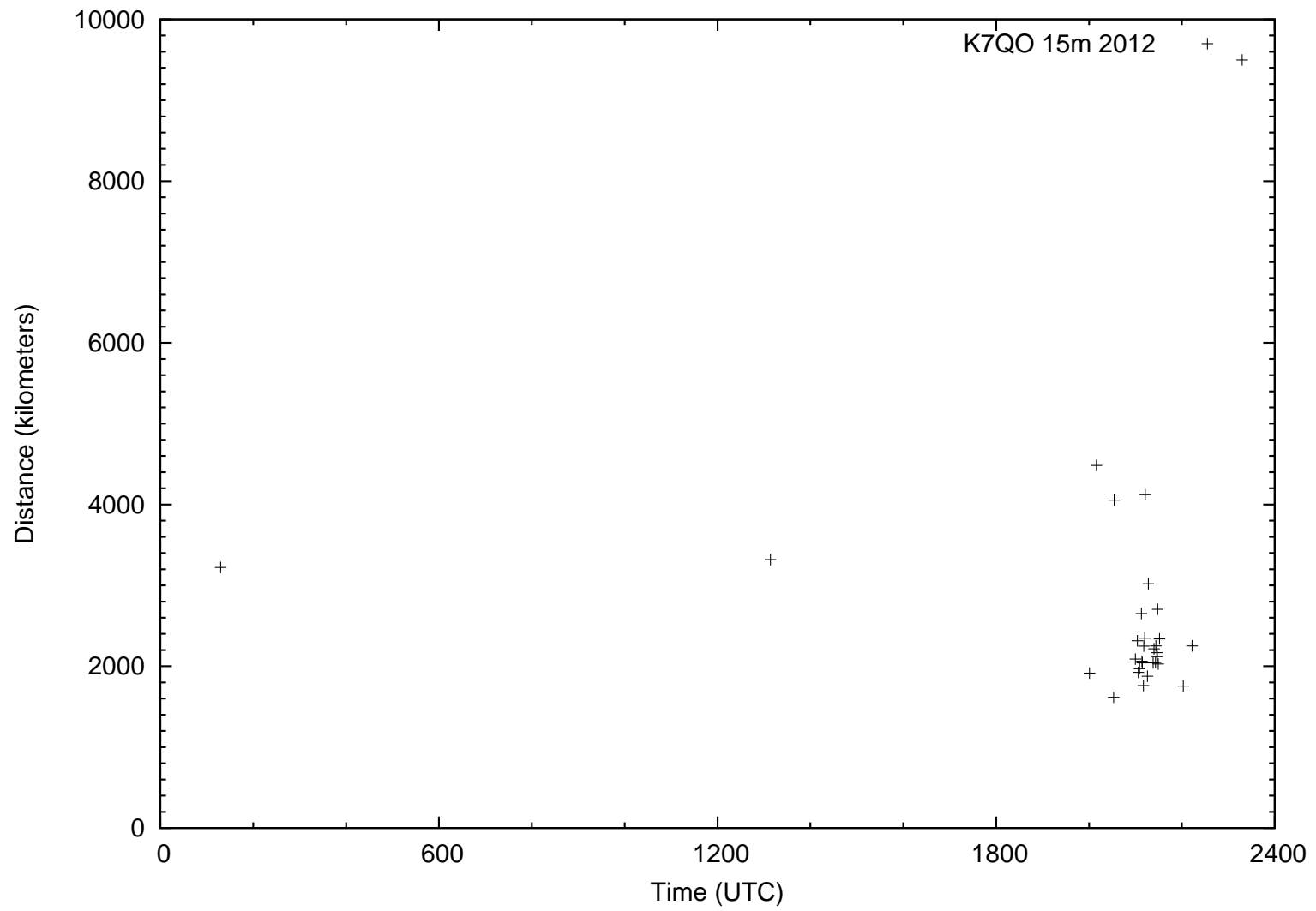
And the best way in the Universe to test conditions is to just call CQ. Now don't do a long one. Just the correct way of 3 x 3 (three by three) with CQ CQ CQ DE UR-CALL UR-CALL UR-CALL K. Listen carefully for even the weakest calls. That might be me you are hearing. :-)

Current Graphical Data

Here is a plot of the current status of stations worked on 15m since June 1, 2011. This is for the purpose of determining if there is any real data to be gleaned from the time of day and the distance of propagation.

As of January 2012 the setup is 4w with an 15m mobile whip (Workman) on a 1m aluminum pole in a center courtyard of the hacienda in Peoria AZ. Total cost of the antenna is thirty US dollars for the whip and the mount. Using 6 meters of RG-58U coax from the antenna to the transceiver. Nothing special and typical of a home controlled by a HOA from Haydes type environment. Just trying to be a good neighbor without having to get legal council if some one decides they don't like my setup.

I also own a W6MMA two-element beam with a 6 meter push-up pole and I want to dig it out and experiment with it. Photos when I get a chance.



States and Countries Worked

- AK, AR, AZ, DE, GA, HI, IL, IN, LA, MN, MO, MS, NC, ND, OH, OR, TN, TX, WA, and WI
- VE7, JA2, VK2, XE1, 6Y5, CO3, HL2 and W7

So far (Jan 25, 2012) : twenty states and eight countries including the USofA.