Before the
Federal Communications Commission
Washington, D.C. 20554
In the Matter of

Amendment of Parts 2, 15, 80, 90, 97, and 101 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2012)(WRC-12), Other Allocation Issues, and Related Rule Updates **(ET Docket No. 15-99)**

With regard to the compatibility between amateur operations and power-line communications in the proposed 630-meter amateur band (472-479 kHz).

I have been coordinator of the ARRL 500-kHz experiment since its inception in 2004. However, I am filing these comments on my own behalf as an amateur-radio operator and an electronics engineer with over forty years of experience in radio communications. These comments do not necessarily reflect the opinion of the ARRL or any other organization or individual.

Our experimental license WD2XSH provides 45 transmit sites located across the continental USA as well as Alaska and Hawaii. Since beginning operations in 2006, we have logged over 180,000 transmitting hours in the 600 and 630 meter bands. Many other experimental stations have also been operating in this band, and many with higher power than the 20 W ERP that WD2XSH is allowed. To date, there have been no interference complaints from any source.

A number of experimental stations operating in the 630 and 2200-meter bands are quite close to power-transmission lines (see Appendix). Some of these are known to have power-line carrier (PLC) communications. There have been no reports of interference to the PLC systems.

The Silva and Whitney paper (see below) shows only 20 PLC systems in use in the range of 450 to 490 kHz in 1999. It is doubtful that more have been added as utilities are using fiber-optic systems for new links. If a 1-kHz guard band is added to each side of the proposed 630-meter amateur band, the range of frequencies that may need protection is 471 to 479 kHz. Assuming a uniform distribution of PLC frequencies from 450 to 490 kHz, only five PLC systems nationwide are likely to be operating in the band from 471 to 479 kHz. The proposed 630-meter band is therefore not a concern to the vast majority of the PLC systems deployed nationwide (5/28,816 or *** percent, based upon the Silva-Whitney paper).

Significant pick-up of a propagating radio wave by a transmission line can occur only with a very unlikely combination of geometries. When the PLC is applied between two lines (phases), the transmission line is balanced and much like with twin lead, the pick-up of radiated signals is minimal. Signals are induced in a horizontally polarized line only by a horizontally oriented electric field, and then only by the component of the field aligned with the line. Since amateur signals will be principally vertically polarized, any signal pick-up by the line will be due to the much smaller horizontal electric field. Thus even when the PLC is applied from line to ground, significant signal pick-up can happen only for unusual combinations of PLC configuration and geometry. Consequently, only a fraction (2 or 3) of the five or so PLC systems operating in or near the 630-meter band could be affected by amateur operations.

The potential for interference to a PLC system from a 630-meter amateur station exists only in those few cases where the PLC frequency is in or very near the amateur band. Even those few cases, interference will be possible only for unlikely combinations of PLC configuration and power-line geometry.

Both amateurs and utility operators will ultimately benefit from minimal restrictions. I therefore propose the following approach for transitioning into use of the new bands:

(1) There is no reason to restrict amateur operation around the vast majority of power-transmission lines that do not have PLCs, or have PLCs whose frequencies are not in or near the 630-meter band. The power industry will therefore need to identify those few transmission lines with PLC signals in near the 630-meter amateur band. This will eliminate any ambiguities about which lines require protection, to the benefit of both amateurs and utilities.

(2) A distance of 1 km or more should be sufficient for the proposed ERP of 5 W.

(3) The above two points will determine corridors within which amateur operation will, for the time being, be subject to additional restrictions. For example, an amateur located 0.5 km from a transmission line could be allowed a maximum of only 1.25 W ERP, based upon the above assumption and free-space propagation.

(4) It should also be possible to define a tolerable interference level relative to the received PLC signal. A signal-to-interference ratio of 10 dB is sufficient in most digital systems. The interference level could be measured at the PLC receiver to determine the allowable ERP for a specific amateur station. This technique is preferable to the corridors technique above because it is a positive check on the interference level.

The above four points provide a mechanism for opening the new bands to amateur operations. In the long run, both amateurs and utilities will benefit from separation of frequencies. I therefore further propose that:

(5) No new PLC systems shall be implemented in or near the new amateur bands. There is plenty of other spectrum available for PLCs between 9 and 490 kHz. In practice, it is unlikely that many new PLC systems will be implemented as the utilities are largely transitioning to more secure fiber-optic links.

(6) Over a period of time (e.g., 3-5 years), utilities with PLCs whose frequencies are in the amateur bands should change frequency to something outside the band. This will eliminate any possibility of interference. This time period allows the utilities to incorporate the frequency change into normal maintenance and upgrade cycles. As a result, the cost of the change will be negligible.

(7) At the end of this period, there will be no further possibility of amateur-PLC interference. Restrictions on amateur use of the new bands can then be removed from the rules.

Respectfully submitted

Frederick H. Raab, Ph.D.
Extra-class amateur operator W1FR
Chief Engineer and Owner
Green Mountain Radio Research LLC
1183 Jonquil Lane
Boone, Iowa 50036
www.gmrr.biz

Reference: J. M. Silva and B. Whitney, "Evaluation of the potential for power line carrier (PLC) to interfere with use of the Nationwide Differential GPS network," *IEEE Trans. Power Delivery*, vol. 17, no. 2, pp. 348 - 352, April 2002.

APPENDIX. PROXIMITY OF EXPERIMENTAL STATIONS TO POWER LINES

STATION	BAND	ERP, W	D, km	COMMENTS
WD2XDW	2200	3	1.6	138 kV
WD2XSH/6	630	15	1.6	Lines to Navy base
WD2XSH/12	630	1	0.4	Xcel Energy
WD2XSH/14	630	2	0.93	
WD2XSH/15	630	2	3.2	Major N-S line, Entergy
WD2XSH/16	630	1	0.30	
WD2XSH/19	630	0.25	0.61	
WD2XSH/23	630	5	0.27	PLC 196 kHz
WD2XGJ WE2XEB/2 WE2XGR/1	2200	4		
WD2XSH/26	630	0.01	0.015	Comm. distrib., local grid
WD2XSH/31	630	20	0.77	128 kV CW
WG2XFQ	630	20	0.77	Full-carrier AM
WD2XSH/33	630	0	1.25	161 kV
WD2XSH/44 WA	630	0	0.61	
WD2XSH/45	630	1.7	1.44	100-ft poles
WE2XPQ Wasalia/Palmer	630	30	5.26	Multiple LF/MF PLCs
	2200	1		Interconnector
WE2XPQ Anchorage	2200	3	0.06	Buried
		2.1		Main generator Chugach
WG2XKA	630	5	2.0	Substation, hydro, solar
WG2XPJ	630	1	0.8	
WG2XSV UT	630	1	0.13	
WG2XSV WA	630	1	0.33	
WH2XGP	630	10	1.6	DoI Columbia Grand Coulee
			2.0	Pair, Grant County PUD
VE7BDQ	630	5	0.56	

2200 0.2