Before the

Federal Communications Commission
Washington, D.C. 20554

In the Matter of	**)**	
Inquiry Regarding Carrier Current Systems,	**)**	**ET Docket No. 03-104**
including Broadband over Power Line Systems	**)**	

REPLY COMMENTS of Philip Camera
Amateur Radio Operator and Engineer to the Comments Submitted by the National Telecommunications and Information Administration and the American Amateur Radio Relay League.

The following are a set of reply comments from Philip R. Camera, a licensed Amateur Radio Operator (Extra Class licensee, callsign KB9CRY) and an engineer with a Bachelor of Science degree from the Illinois Institute of Technology (June, 1979).

My comments are a reply to comments submitted by the National Telecommunications and Information Administration (NTIA) and the American Amateur Radio Relay League (ARRL).

I am an experienced and extremely active Amateur Radio Operator who has particular interest in weak signal propagation and also participate in emergency communication assistance.

The following reply comments take the form of excerpts from the NTIA and ARRL comments (italicized) followed with my reply remarks.

1. Comment (NTIA)

NTIA believes that Broadband over Power Line (BPL) holds great promise as a new source of innovation and competition in the broadband marketplace. It has the potential to open new avenues of Internet access, to enable new and expanded services for utility companies, and to create a new platform for further advances in communications technology. By moving swiftly to examine BPL and to establish appropriate rules for its use, the Commission can provide this emerging industry with a solid foundation upon which to build new services and products that will benefit American consumers and businesses.

Comment (ARRL)

3. The Amateur Service has struggled with terrestrial interference in the HF bands for years. Interference at HF and low VHF is received from a variety of sources. However, a principal source of reported interference is above-ground power lines. ARRL has researched interference from power line radiation for some years, has assisted in

interference resolution efforts, and keeps careful logs of interference cases. Power line noise is the single most frequently identified source of HF interference to licensed Amateur Radio operators. During 2002 and 2003 to date, there have been 245 interference complaints reported by ARRL members to ARRL. These are cases in which the radio amateur has not been able to obtain cooperation from the utility company involved. ARRL estimates that this is but a small portion of the number of actual cases of power line interference to Amateur Radio. Most cases are addressed by the Amateur licensee and the utility company, or else the radio amateur merely suffers the interference where cooperation from the utility is not forthcoming. Of the 245 serious power line interference cases reported to ARRL, 108 of these have resulted in letters being sent by ARRL technical staff to the utility companies. These letters are not sent by ARRL without good cause. They are sent only when informal, cooperative efforts at resolving the interference problems fail. A total of 86 different utility companies have been involved in these written complaints during 2002/03. In a total of 40 cases, ARRL finally had to refer the matter to the Commission's Enforcement Bureau for resolution, due to non-responsiveness on the part of the utility over a long period of time. Mr. Hollingsworth of the Commission's Enforcement Bureau (who has been extremely responsive and helpful) has sent out letters to 23 different utilities about power line interference problems during 2002 and 2003, representing the most egregious cases. It is fair to say that power line interference to Amateur Radio has been a substantial regulatory burden to the Commission. It is a very substantial problem now for the Amateur Service, without the addition of BPL to the mix.

4. Most power line noise complaints involve several calls to the utility from the complainant. Several visits from an RF interference investigator are typically required. Some utilities, even those attempting to be responsive, lack the ability to resolve power line interference problems readily, efficiently and economically. Most often, the case remains open. Some in ARRL's experience have continued for almost ten years. It is with this experience as a predicate that the Amateur Service views with concern and alarm the Commission's consideration of the use of power lines, an excellent radiator of HF and low VHF signals, for broadband delivery to homes on HF and low VHF frequencies.

Reply

The NTIA states that BPL will open new avenues for utility companies and provide consumers with additional choices of Internet access. However the ARRL's experience and consideration of recent events dictate otherwise. The recent power blackout that has affected the Midwest and Northeast sections of the United States poignantly points out that the utility companies have problems with the nation's power distribution system. It has been widely reported in the news media (CNN, Fox, ABC, NBC) that many experts agree that the nation's power distribution system is severely out-dated and will require billions of dollars of upgrades to provide reliable power to consumers. Attempting to provide Internet access will merely saddle the utility companies with new systems to maintain and reduce resources needed to upgrade the power distribution system; it will also contribute to increased costs which will be most definitely passed along to the consumer. The ARRL's current experience with the utility companies points out that they are in severe need of resources at this time. I believe that there are plenty of options for Internet access available to consumers at this time. Those who live in rural areas who do not have high speed service are merely the victim of demographics and/or in-fighting between Internet providers which has also been widely documented in the news media. I believe the existing Internet access technology can adequately meets everyone's needs; some may have to merely wait for that to come to fruition. I also strongly doubt any power utility company's ability to provide a new service whilst maintaining and upgrading their existing service. (Also pointed out two years ago here in the Chicago area with problems of power blackouts in the City of Chicago caused my failing, outdated Commonwealth Edison equipment.)

2. Comment (NTIA)

In tailoring its rules to promote BPL deployment, the Commission must be certain to provide all communications stakeholders with adequate protections against BPL emissions that may cause unacceptable radio frequency interference. The federal government has extensive operations that potentially could be affected by BPL systems.

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These assignments accommodate many tens of thousands of receivers operating throughout the United States, in many cases in close proximity to potential sites for "In-House" and "Access" BPL systems.[2] The systems that operate in this region of the spectrum provide numerous services, such as national fire emergency communications, federal and non-federal law enforcement communications, emergency operations, search and rescue, aeronautical and maritime communications, and disaster relief communications. Some of the Federal Government systems utilize Automatic Link Establishment (ALE), encryption and other technologies that affect the tolerance to interfering signals. Consequently, NTIA has broad concerns with radiated emission limits and other measures that may be needed to protect these systems.[3]

Comment (ARRL)

ARRL will take the Commission at its word regarding the premise at Paragraph 18 of the Notice, which states as follows:

> *In both Access and In-House high-speed BPL technologies, multiple carriers spread signals over a broad range of frequencies that are used by other services that must be protected from interference. In the spectrum below 30 MHz, incumbent authorized operations include…amateur radio terrestrial and satellite…In the spectrum from 30 to 300 MHz, incumbent authorized operations include… amateur radio terrestrial and satellite…Each of these authorized services in the spectrum must be protected from harmful interference.*

It is unclear, however, whether the Commission is cognizant of the extreme sensitivity of HF receivers deployed in the Amateur Service, and the extensive disruption of ongoing Amateur Radio communications in the heavily used allocations which would result from deployment of BPL in the HF bands allocated to the Amateur Service. Any such interference can also be presumed to affect other services, in addition to the Amateur

Radio Service, which daily conduct terrestrial emergency and safety of life communications in the HF bands.

The greatest interference potential from BPL to Amateur Radio is with respect to "access BPL" systems, which would provide broadband Internet access to homes and businesses, using electrical distribution wiring. Overhead wiring is a far better conductor of HF signals than is the electrical wiring within a building. Entire communities will be affected by radiated BPL emissions, and it can easily be seen that interference to Amateur Radio stations will, as a practical matter, not be resolved where the solution is to cease operation of a BPL system in a community. In situations where an Amateur station creates interference to an access BPL system, the level of tolerance of broadband consumers to that interference will be extremely low indeed. So, irrespective of the Part 15 status of BPL, incidents of interaction between the Amateur Service and BPL systems on HF frequencies can be expected to be resolved (in the unlikely event that they could be resolved at all), to the unilateral detriment of Amateur Radio operators.

15. The conclusions to be drawn from the ARRL Study at Exhibit C, are as follows. As can be seen from Table 3, received signal levels of BPL noise at typical amateur stations are, in worst cases, between 33.7 and 65.4 dB higher than typical ambient noise levels. BPL cannot be deployed using Amateur allocations in the MF, HF and VHF bands without severely high interference potential. To prevent widespread harmful interference from BPL systems, all MF, HF and VHF amateur spectrum must be avoided. The maximum emission limits in Part 15 will result in strong BPL signals being received by nearby Amateur receiver systems, at levels typically as much as 65 dB higher than the otherwise ambient noise floor. Amateur stations in some especially quiet

locations, and stations with antennas that must be located close to electrical wiring will be degraded even more. Even if Amateur spectrum is avoided, the spurious and out-of-band emissions from BPL systems operating on adjacent spectrum must be deeply suppressed. Amateurs whose antennas must be located closer than 30 meters from the radiating power lines will need up to 100 dB of suppression of spurious BPL emissions to operate free of harmful interference. This level of suppression is difficult to obtain.

Reply

Both the NTIA and ARRL are concerned about the interference of existing services from BPL technology. I learned back in college that radio frequency energy transmitted into a wire will cause the wire to emit radio signals in many directions. I have deep concerns regarding the entire concept of BPL (all aspects) to not cause interference to existing radio services. I do not believe that any relaxation of existing Part 15 or any other rules are required, in fact, they ought to be strengthened to unequivocally ensure that no interference is created and that the BPL technology be ceased until any interference is eliminated. BPL will surely affect my weak signal operations, if not rendering them entirely useless. I also understand that existing radio services will most probably affect the BPL transmissions. I believe the undertaking is too difficult and complex to be a cost effective means to deliver Internet access. Existing fiber optic or cable broadband services are a shielded and therefore usually immune from causing interference or being affected by external signals.

3. Comment (NTIA)

NTIA IS LAUNCHING EXTENSIVE MODELING, ANALYSIS, AND MEASUREMENT EFFORTS FOR BPL AND WE ENCOURAGE THE COMMISSION TO CONSIDER OUR FINDINGS AS IT MOVES FORWARD IN THE BPL PROCEEDING.

In the inquiry, the Commission requests comment on how the Part 15 rules should be tailored to ensure that existing radio services are protected from harmful interference.[4] The Commission's inquiry also requests comment on the measurement methods to be used for BPL systems.[5]

NTIA has initiated modeling and analyses that address the interfering potential of BPL technology and the radiated emission limits needed to preclude unacceptable interference to federal government systems. This effort includes research of relevant technical studies and measurement efforts that have been performed throughout the world as well as regulatory approaches taken for BPL (e.g., carrier current systems) by

other countries. NTIA's Institute for Telecommunication Sciences (ITS) is also commencing extensive measurements of experimental BPL systems. The measurements are designed to define the local ambient noise environment and reveal the most important BPL radiated emission characteristics for use in NTIA's modeling and analysis efforts. Based on the results of this effort, NTIA will recommend radiated emission limits and other operational restrictions for BPL systems that are necessary to preclude unacceptable interference to federal government systems.

NTIA additionally has a substantial interest in BPL authorization procedures, especially the measurement procedures for ascertaining compliance with radiated emission limits. These procedures must correctly determine compliance without undermining the protective effects of the limits. However, the procedures should not unnecessarily restrict the emission limits or cause service providers to incur undue costs or delays in deployment. The measurement performed by ITS will provide guidelines for development of compliance measurement procedures that NTIA believes are a key factor in ensuring compatibility with federal government systems. A copy of the measurement plan is provided in Appendix A.

NTIA expects to conclude its modeling, analysis, and measurement efforts by the end of 2003. NTIA intends to submit its findings to the Commission, and we urge the Commission to consider those findings as it moves ahead with successive stages of the BPL proceeding.

Comment (ARRL)

The Notice, beginning at paragraph 20, asks a series of questions regarding interference potential of BPL. These are addressed these in the order in which they are asked in the Notice. The first series of questions addresses use of high-pass filter circuits, and the effect of those on HF signals inside residences from in-house BPL technologies. The problem with the use of high-pass filters as a means of getting a BPL signal past lossy transformers is that they will not only couple the BPL signal onto the MV lines, they will also couple all other RF noise generating device in every building onto the line as well. This will significantly increase the interference potential of devices that otherwise would have been only a local interference source. The MV lines, which may have been relatively quiet previously, will become the distribution source for in-building RF noise. The interference potential from the use of high-pass filters has not, apparently, been

conclusively studied, but it will surely impact both the interference potential from a BPL device, and the potential from other conducting emitters in unknown ways. It would be highly premature to permit the use of these filters without knowing more about the interference potential of them using good science.

10. As to the various methods of RF signal injection onto "medium-voltage" (MV) lines, and the effect of different methods on access BPL interference potential, a study of alternatives is attached hereto as Exhibit B.[1] *This study was conducted by the ARRL Laboratory staff. It notes differences in the way that MV distribution lines conduct and radiate signals based on the way RF power is fed to the lines. Using an established antenna-modeling program, EZNEC/4 with the NEC-4 calculation engine, ARRL modeled a simple MV power line and two nearby amateur antennas, conservatively located 30 meters from the lines. Three different models reflected three different ways of feeding the antenna, to-wit: differential feed between two phases, at one end; one phase to Earth ground, in the center; and one phase fed differentially similar to the way a dipole is fed, offset on the ungrounded phase.*

11. Some conclusions drawn from the study are as follows: Feeding the power line as a dipole is the worst choice from an electromagnetic compatibility perspective. It results in a high powerline antenna gain and greater coupling to the simulated Amateur antennas. At 14 MHz, perhaps the most popular and overcrowded Amateur HF allocation, the gain of the powerline antenna fed in this manner is high enough that the power line has more gain than many antennas intentionally deployed by Amateurs for that band. Feeding the line differentially or from one phase to the ground does result in some improvement in the amount of BPL-signal power delivered to the modem load and

in somewhat less energy radiated to the simulated amateur antennas. This does not remove the interference potential, which is governed by Section 15.209 of the Commission's Rules.

12. However, it should be noted that the radiation pattern resulting from the model is complex, and much radiated energy is in upward directions on multiple lobes. There is significant coupling between the modeled power line and the modeled amateur antennas, but it is unclear whether the assumed separation distance represents a worst-case analysis for this model. The antennas as modeled are located in the radiating near field of the large power line radiator. The near-field effects and the assumed height of the antennas (the first being in the same horizontal plane as the power line; the second 20 meters higher) which results in the amateur antennas being outside the maximum field above the power line, result in this case in somewhat less energy at the modeled point than the path loss calculation would dictate.

Reply

Both the NTIA and ARRL have valuable experience and expertise in RF Energy, Radiation of RF Energy, and Antenna Modeling. I urge the commission to please consider the offer of their assistance in determining the criteria under which BPL should operate and to include their modeling and testing data in it's future decisions.

Conclusion

I urge the Commission to closely examine both the NTIA and ARRL comments and to give them the utmost consideration. Scientifically BPL is possible but I believe it to be fraught with serious technical problems that will require much innovation to overcome. I do not believe that power utility companies have this expertise and surely should not consider the same to exist; power utility companies should invest all of their resources in maintaining and upgrading their existing systems. I believe the existing Internet access choices to consumers are adequate and that the Commission should support those and help direct availability of same to consumers who do not yet have such access choices.

I wish to thank the Commission in allowing me to submit my reply comments and trust that they will make wise choices and not be swayed by outside pressure.

Respectfully yours,

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