Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	**)**	
	)	
Inquiry Regarding Broadband	**)**	**FCC Docket No. 03-104**
over Power Lines (BPL)	**)**	
	)	

Comments of Scott D. Prather
Amateur Radio Operator N7NB

Introduction

In response to the Federal Communication Commission's Notice of Inquiry regarding Broadband over Power Lines (BPL, FCC Proceeding #03-104), I, Scott D. Prather, licensee of amateur radio station N7NB, wish to provide the following comments for consideration by the Commission.

Through the BPL NOI, the Commission has expressed considerable interest in allowing electric utilities and other interested parties to provide broadband data communications services to homes and businesses using the existing power line infrastructure as a transmission medium. Industry consortia have indicated their desire for the FCC to make modifications to the existing FCC Part 15 rules pertaining to unintentional radiators in order to facilitate the deployment of BPL.

While the Commission's interest in revising Part 15 to accommodate requests from the BPL industry is understandable, any decision to move forward with rule changes must take into account the potential interference aspects of BPL. Such issues will require careful consideration during the regulatory phase of this proceeding in order to ensure that harmful interference is not caused to other licensed services.

Discussion

The development and deployment of BPL is currently supported by two industry consortia, the Power Line Communications Association (PLCA) and the United PowerLine Council (UPLC). In their filing with the FCC on 3 March, 2003, titled "Joint report of the Power Line Communications Association and the United PowerLine Council regarding the State of the Power Line Communications Industry", these consortia urged the Commission to act swiftly on its review of the regulations surrounding unintentional radiators below 30 MHz. Among other things, the consortia claimed that "archaic" regulations were holding back the development of this new technology. I would like to point out that the laws of physics predate any of the "archaic" rules the PLCA and the UPLC find objection to, and the existing Part 15 rules are soundly founded on the laws of physics.

The PLCA and the UPLC have proposed to provide BPL as a "carrier current" transmission along the existing power grid. Their proposed service would utilize frequencies between 2 and 80 MHz, and any emissions from the power lines would be considered "unintentional", since the desired signal is injected into the power line itself.

While it may be the UPLC/PLCA's *intent* that BPL carrier-current communications take place exclusively over the power lines, in reality BPL signals *will* radiate over wide portions of the HF radio spectrum, regardless of how well the system was designed. The degree to which this radiation takes place is highly dependent upon local variables introduced by the power grid and its environment. However, as a general rule of thumb—between 2 and 30 MHz—the radiation efficiency of power lines increases as frequency increases, meaning that an "unintentional radiator" such as PLC is far more detrimental as an interference source above 2 MHz than it would be below 500 kHz.

An important aspect of BPL's interference potential that must be considered by the Commission deals with that of national security. Currently, there are over 600,000 licensed amateur radio operators in the United States, and the stations that these licensees own and operate comprise a vital aspect of our country's emergency preparedness. While the existing common carrier infrastructure is considered to be the heart of our countries's communications network, the amateur radio community has a long history of providing emergency communications when the common carrier infrastructure is damaged or destroyed, or in areas where it may not even exist. If BPL were deployed in a manner that makes the HF radio spectrum useless, many of the existing amateur operators would give up the hobby entirely and sell off their equipment, severely weakening an important aspect of our nation's emergency infrastructure.

Questions to the BPL Industry

In addition to the many questions cited by the Commission in the BPL NOI, I would like to suggest that the industry be tasked with answering these questions as well:

1) Operation of all devices under Part 15 of the FCC rules must take place on an unprotected, non-interference basis. To mitigate any interference, the Part 15 device may be required to lower its output power, change operating frequency, or in some cases, cease transmission. With interference to amateur stations a near certainty in some locations, how does the BPL industry intend to uphold its obligations under this requirement?

2) BPL has been proposed and tested in several countries, including Germany, Norway, the Netherlands, Japan and the United States, to name a few. Of all these countries, the United States has the most liberal emissions restrictions for carrier-current systems operating below 30 MHz. In addition, the FCC's allowance of a 40 dB/decade calculation of radiated emissions at close range effectively relaxes the radiated limits in FCC § 15.209 even further. In a paper published in the May, 2003 issue of IEEE Communications magazine, authors Gebhardt, Weinmann and Dostert state that: "Compared to the European limits currently under discussion, FCC Part 15 can be

regarded as highly generous for high-speed PLC and in no way obstructing the spreading of PLC technology"[1]. Given this liberal regulatory environment for BPL under the current FCC rules, on what basis is the industry requesting changes to Part 15 in order to deploy BPL?

3) In their filing with the Commission, on the subject of field trials the UPLC/PLCA state that "None of the field trials have caused any interference to home entertainment equipment, licensed wireless services or other spectrum users." This is an extremely broad statement that should cause the Commission to question the means by which they made this determination. For example, did they determine that BPL didn't cause any interference to local AM or FM broadcast stations or to mobile telephones (all of which are outside the bandwidth of BPL) or did they make an effort to see if "spectrum users" within the 2-80 MHz bandwidth of BPL were affected? What effort did the industry expend to ascertain the level of interference to "other spectrum users"?

4) The AC power grid was never intended to serve as anything other than an efficient transmission medium for extremely low-frequency AC power. As a result, the electrical characteristics of power lines (such as their characteristic impedance vs. frequency) are constantly changing as AC electrical loads change within the grid. In addition, the power grid in the United States was built up over a long period of time, making its characteristics difficult to model, monitor and control. Nowhere in the UPLC or PLCA filing did these consortia address how they would assure compliance with any new Part 15 rules promulgated by the Commission, nor did they indicate how a "typical" BPL system would be measured for compliance, even against the existing Part 15 rules applicable to BPL.

Recommendations

Through numerous industry papers and journal articles, the general consensus is that BPL systems which operate in the 2MHz to 80 MHz frequency range will be deployed. Their selection of these two frequency limits appears to be intended to provide protection to the AM broadcast band (0.54-1.7 MHz) and the FM broadcast band (88-108 MHz).

The 2 MHz to 80 MHz frequency range proposed for BPL, while excluding the AM standard broadcast and the FM broadcast bands, does include numerous licensed services, including military, state and local government, maritime mobile, aeronautical mobile, amateur radio, international broadcasting, radio astronomy and television channels 2 through 5. All these services are at risk for interference from BPL, however, amateur radio international broadcast and television broadcast (channels 2-5) will suffer the most since receivers for these services are typically located in residential areas where the power grid is relatively dense.

Regardless of the technology used to implement BPL in the United States, the FCC should consider imposing the following protected bands in order to mitigate interference:

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1. Martin Gebhardt, Frank Weinmann, Klaus Dostert, *"Physical and Regulatory Constraints for Communication over the Power Supply Grid"*, IEEE Communications Magazine, Volume 41, Number 5, May, 2003, page 90.

Table 1: Minimum Set of Frequency Bands Requiring Protection from BPL

1.8-2 MHz	10.1-10.15 MHz	21.0-21.45
3.5-4 MHz	14.0-14.35 MHz	24.89-24.99
5.3-5.4 MHz	18.06-18.17 MHz	28.0-29.7 MHz
7.0-7.3 MHz	19.9-20.3 MHz[a]	50.0-54.0 MHz

a. This frequency range was included to protect decimeter-band radio astronomy

Precedent for such protection already exists in the case of In-House BPL, where the HomePlug 1.0 standard specifically includes notches to protect the amateur radio bands that fall within its 4.5-21 MHz operating range. In addition to the HF band protections in Table 1, "floating" protected bands would be required from 54-80 MHz to accommodate any active television channels 2 through 5 specific to each area where BPL is deployed or to protect public and/or private users of the low-VHF band (30-50 MHz).

Conclusion

The FCC's predecessor, the Federal Radio Commission, was formed in 1927 to bring order to the otherwise chaotic radio environment of the early 1920's. In those days, competing interests such as ship-to-shore, broadcasting, amateur, etc. were close to making the radio spectrum useless. Spark transmitters, once workhorses of the maritime communications industry, were outlawed, as they created severe interference to other radio services over wide areas. Since then, the FCC has always kept the importance of proper spectrum management in mind as it promulgated new rules or modified old ones in order to adopt to changes in technology and the marketplace. It is extremely important that the Commission take the interference aspects of BPL seriously, as an improper regulatory environment for this technology could easily create the 21st century equivalent of the spark transmitter, impacting hundreds of thousands of HF radio users.

As a closing note, the Commission should also remember that the Internet is currently available to a very high percentage of Americans, and in many areas, more than one alternative for Internet access exists. Conventional telephone communications are available to virtually everyone in the United States. Both the Internet and the telephone network are based on an extremely complex infrastructure that has proven to be easily damaged in the event of disaster. Under such conditions, the HF radio spectrum is the only means of providing long-distance communications without the need for any infrastructure whatsoever. This unique aspect of the HF spectrum makes it an extremely valuable resource that must not be compromised by an industry looking for an expedient means of providing redundant Internet service.

Respectfully Submitted,
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