

**BEFORE THE  
FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON, DC 20554**

In the Matter of )  
 )  
Amendment of Part 15 Regarding New ) ET Docket No. 04-37  
Requirements and Measurement )  
Guidelines for Access Broadband over )  
Power Line Systems )

To: The Federal Communications Commission

**COMMENTS  
OF  
RONALD K. WRAY**

Dated: May 2, 2004

## TABLE OF CONTENTS

<b>I.</b>	<b>SUMMARY .....</b>	<b>i</b>
<b>II.</b>	<b>PRELIMINARY STATEMENT.....</b>	<b>2</b>
<b>III.</b>	<b>COMMENTS .....</b>	<b>3</b>
	<b>A. BPL Systems Pose a Substantial Risk of Interference to Incumbent Licensed Services in the MW, HF, and VHF Portions of the RF Spectrum and Therefore Should Be Limited To Operation Only at Microwave Frequencies .....</b>	<b>5</b>
	<b>B. BPL Systems May Interfere with Emergency Notifications from the Emergency Alert System in the AM Broadcast Band .....</b>	<b>14</b>
	<b>C. Sensitive Frequencies and Critical Services Require Coordination or Protection, And a Mechanism is Required to Reimburse Incumbents for Related Costs .....</b>	<b>15</b>
	<b>D. Implementation of the Interference Avoidance and Mitigation Methodologies Proposed by the Commission May be Insufficient to Protect Licensed Services .....</b>	<b>16</b>
	<b>E. Stringent Procedures Should be Implemented to Determine Compliance of Emissions from BPL Systems.....</b>	<b>18</b>
	<b>F. BPL Systems May Be Subject to Other Factors Which Could Increase the Potential for the Generation of Harmful Interference, and The Commission Should Await Phase II of the NTIA Study Before Concluding This Proceeding .....</b>	<b>22</b>
	<b>G. The NTIA Study, Phase I, Should be Incorporated Within the Official Record of This Proceeding .....</b>	<b>23</b>
<b>IV.</b>	<b>CONCLUSION .....</b>	<b>23</b>

## SUMMARY

As a Manager of RF and Wireless Services and an RF Engineer with over 29 years of experience, I am responsible for the reliable operation of over 10,000 licensed and unlicensed radio devices supporting a major Critical Infrastructure Industry ("CII") entity. As an Extra Class licensee in the Amateur Radio Service, I have operated station WB5HZE for over 30 years and keep this station prepared to support the public welfare in the event of a civil emergency. As a private citizen I am reliant upon services delivered by multiple incumbent licensees on the MW, HF, and VHF portions of the RF Spectrum. The continued operation of all such systems-- free from harmful interference-- is essential to protecting lives, health, property, and the natural environment. I have serious concerns, echoed and verified by the National Telecommunications and Information Administration ("NTIA"), regarding the potential for harmful interference to the vital services provided by incumbent licensees from Access BPL ("BPL") systems. It is my opinion that the Commission may have greatly underestimated the potential for the generation and propagation of harmful interference caused by BPL systems. While I concur that BPL systems may offer benefit to the general public, including that of furthering broadband competition, I believe that the risk of interference to vital services outweighs such benefit in the case of BPL systems operated in the MW, HF, and VHF portions of the RF spectrum, and instead propose that BPL systems be limited to operation only upon Microwave frequencies.

I am also concerned about BPL's potential to interfere with emergency notifications from the Emergency Alert System on the AM Broadcast band. Due to the ubiquitous presence of power lines along the nation's roadways, motorists in particular might be placed at high risk during a civil emergency due to a failure of the receivers in their vehicle to receive broadcast

emergency information over the interference caused by BPL signals radiating along those power transmission lines. I propose that BPL emissions be prohibited in the AM Broadcast Band.

Many services are assigned critical or protected frequencies for various purposes, and especially for protection of the public safety and environment. I propose that BPL emissions upon such frequencies be prohibited, and that the Commission develop a reimbursement mechanism so that incumbent licensees may recover costs associated with coordination with BPL operators, or for the relocation of their systems should such prove necessary.

I applaud the initiative evidence by the Commission's contemplated application of interference mitigation technologies and processes, but question their potential effectiveness. In particular, cognitive avoidance technology falls short by its inability to detect passive receivers operated by an incumbent licensee, and thereby risks causing interference to communications in progress. I am also concerned about delays inherent in any manual mitigation process.

The Commission contemplates a test regimen to determine the compliance of BPL system emissions with Part 15. I suggest that the proposed test requirements are insufficient to determine whether emissions are compliant, and suggest an alternative regimen. I also propose that testing of representative BPL systems is inadequate to assure compliance and therefore recommend that all installed BPL equipment and systems be tested in the field. Further, I hold that the acceptable peak emission levels under Part 15 are not appropriate for BPL systems due to the unique nature of such systems, and urge the Commission to mandate a more appropriate maximum emission level for the special case of BPL systems.

Insufficient consideration has been given to the potential effects of BPL-related spurious emissions, intermodulation products, and sky-wave propagated signals. I propose that the Commission await the release of Phase II of the NTIA's study before closing this proceeding.

BEFORE THE

FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON, DC 20554

In the Matter of )  
 )  
Amendment of Part 15 Regarding New ) ET Docket No. 04-37  
Requirements and Measurement )  
Guidelines for Access Broadband over )  
Power Line Systems )

To: The Federal Communications Commission

COMMENTS  
OF  
RONALD K. WRAY

I, Ronald K. Wray, am pleased to submit these Comments to the Federal Communications Commission (“FCC” or “Commission”) in response to the Notice of Proposed Rule Making (“NPRM”)<sup>1</sup> released on February 23, 2004 that looks toward the adoption of new rules regarding Access Broadband over Power Line (“BPL”) systems. As further discussed herein, I urge the Commission to ensure that BPL operations do not create an unacceptable risk of harmful interference to the operations of incumbent licensees in the portion(s) of the radio spectrum targeted for BPL operations, including important incumbents such as public safety; CII entities in the PLMRS and Marine services; aeronautical mobile; military and other Federal entities; amateur radio; radio astronomy; AM broadcasting, and international broadcasting.

---

<sup>1</sup> 69 Fed. Reg. 12612 (Mar. 17, 2004).

## I. PRELIMINARY STATEMENT

1. I am an American citizen who has dedicated the greater portion of my life to the art and science of radio communications. I possess over 29 years of unbroken experience as a Manager of RF services, an RF Engineer, an RF Technician, and a Radio Operator (PG-9-14238), the substantial portion of my career revolving around the petroleum and natural gas industries. As an established participant and now Chairman of a recognized industrial committee, I have previously participated in the development of numerous comments placed before the FCC on various matters of professional interest. I am an active Extra Class licensee in the Amateur Radio Service, and have operated station WB5HZE for well over 30 years. In the best traditions of that service, I keep my station prepared for emergency operation on a variety of modes and frequencies, conduct regular communications with licensees of foreign countries to promote international goodwill, and leverage my station as a personal testing laboratory for the advancement of radio technology. I have previously filed comments relevant to this proceeding during the associated NOI.

2. Regarding my personal and professional activities either separately or in concert, I have a standing interest in the manner by which the radio spectrum is regulated and the manner by which incumbent licensees are protected from harmful interference. I am ultimately responsible for the reliable operation of over 10,000 licensed and unlicensed radio devices operated by a major Critical Infrastructure Industry (CII) entity across a variety of services, modes, and frequencies. I am also responsible for my own Amateur station which has capability to operate on multiple modes over the majority of the bands allocated to the Amateur service, both as a fixed station and as a portable/ mobile station. As a private citizen, I am reliant upon the

continued and unimpaired operation of many licensees operating under authorization by the Commission, including those of public safety, military & federal agencies, commercial broadcasting, maritime, critical infrastructure, and the Emergency Alert System (EAS). To a greater degree or lesser, all of these said entities conduct operations in the portion of the radio spectrum below 80 MHz.

3. Because BPL systems also operate in the spectrum below 80 MHz and over a broad swath of frequencies, the operation of the radio systems for which I am professionally responsible, and the operations of my own Amateur Radio Station, and the operations of many services which support me as a private citizen, are potentially subject to interference from BPL operations. The continued operation of the various radio systems operating in the targeted spectrum is, to a greater degree or lesser, absolutely essential to protecting lives, health and property, be that in support of the day-to-day or emergency operations of my employer or similar CII entities, in support of military or federal operations related to homeland security, the operations of public safety entities such as police, fire, and ambulance, or the less obvious but still significant operation of Amateur Radio stations during civil emergencies. All of these services are vital to the well-being of the nation and its citizens. Due to concern about the potential impact of BPL operations on these services, I submit the Comments below.

## **II. COMMENTS**

4. The Commission seeks comment in its NPRM on new requirements and measurement guidelines for BPL systems. I agree with the Commission that BPL may play a role in competition, and perhaps provide a mechanism to bring broadband to rural and underserved areas. At the same time, the Commission notes in the NPRM that power lines reach into

virtually every home and community in the country. I suggest that this ubiquitous presence magnifies the need for the Commission to proceed with utmost caution in order to avoid potentially serious consequences should BPL be deployed in a manner that is technically unsound. With regard to various statements and conclusions made by the FCC within the NPRM and which have bearing on the ultimate manner by which BPL might be regulated by the Commission, I respectfully disagree as discussed below due to my concern that the Commission has greatly underestimated the potential for harmful interference to licensed services. I believe that BPL operations as contemplated in the NPRM will have substantial potential to cause harmful interference to incumbent licensed operations (such as those set forth above), and therefore while I applaud the Commission's recognition of the need to protect existing licensed services (NPRM at ¶ 1) I recommend, as discussed below, that the Commission impose thorough and rigid emissions measurement requirements for BPL in order to decrease the likelihood of such interference. Furthermore, I recommend that in addition to measurements for equipment authorization, the Commission require that all field installations be tested- and, if necessary, adjusted- in situ to assure compliance in the site-specific environment, thus minimizing the risk of harmful interference to incumbent licensed operations. I also urge the Commission to adopt stringent and enforceable procedures for ensuring that any interference cases to licensed incumbent operations are promptly identified and resolved. I propose that the Commission adopt an appropriate reimbursement process to permit incumbents the recovery of coordination (or potentially relocation) costs associated with the deployment of BPL systems. I recommend that BPL systems be prohibited from operation in the AM Broadcast band and upon certain critical frequencies used for the support of vital services: further, due to the propensity of BPL systems to cause potentially irreconcilable interference to licensed services upon which the

security and the continued wellbeing of the general public is reliant, I propose that BPL systems be operated only upon the microwave portion of the RF spectrum. Finally, I urge that the document Potential Interference From Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications At 1.7 - 80 MHz, Phase 1 Study, Volumes I and II, National Telecommunications and Information Administration, (April 2004), (hereinafter "NTIA Study") be made a part of the permanent record of this proceeding, and that the Commission evaluate these comments in concert with the material therein, and further recommend that the Commission await the release of Phase II of that study -- and provide for consideration of those findings -- prior to the conclusion of this proceeding.

**A. BPL Systems Pose a Substantial Risk of Interference to Incumbent Licensed Services in the MW, HF, and VHF Portions of the RF Spectrum and Therefore Should Be Limited To Operation Only at Microwave Frequencies**

5. The Commission correctly notes in its NPRM that the frequencies typically used by BPL systems “are also used by licensed radio services that must be protected from harmful interference as BPL systems operate on an unlicensed basis under Part 15 of the Commission’s rules.” (NPRM at ¶ 5). The entities utilizing these licensed radio services include public safety, critical infrastructure industry (CII), aeronautical, maritime, amateur radio, military, Federal, and commercial broadcast. These entities operate within their various services in the best interest of the nation and the general public, and taken in part or in whole are vital to Homeland Security and the common good.

6. I applaud the Commission’s recognition of the need to protect licensed services. At the same time, I question certain statements, conclusions, and omissions on the part of the Commission which might lead the Commission to incorrectly underestimate the actual risk of

harmful interference that BPL systems might impose upon incumbent licensees.

7. The Commission correctly notes that “power lines reach virtually into every home and community in the country” (NPRM at ¶ 1). The Commission fails to note that similarly, power lines are in close proximity to the majority of the nation’s roadways, and extend within the boundaries of most industry and other enterprise within our country. The ubiquitous nature of medium-voltage power lines within our borders is adequate cause to evaluate with caution and a great sense of responsibility any proposed service which makes use of such lines- such as Access BPL, which has the potential to distribute potentially harmful levels of interference in such a widespread and intrusive manner. The Commission recognizes that they should “proceed cautiously” (NPRM at ¶ 33) but only for the valid but limited reason of propagation characteristics and the diversity of users on the spectrum in question.

8. The Commission, on the other hand, “tentatively concludes that the likelihood of such harmful interference is low under the current limits and that where such interference does occur, there are remedies . . .” (NPRM at ¶ 33). I respectfully submit that the likelihood of harmful interference is actually substantial, regardless of existing limits under Part 15, and that while remedies such as avoidance, adaptive mitigation, and cognitive technologies exist they must be adequate to prevent harmful interference to all licensed services across a wide portion of the spectrum under a wide variety of site-specific conditions. It is worthwhile to note that at least one BPL test site, that of Progress Energy Corporation (PEC) in Raleigh, North Carolina, has during this Comment period apparently reached the limit of such mitigation technology as implemented upon their own system while failing to adequately mitigate damaging levels of interference observed by licensees of the Amateur Radio Service who were working closely with PEC during the trial. It is therefore reasonable to question whether this and similar BPL

systems actually possess the necessary additional mitigation capacity to effectively remedy additional harmful interference to any additional licensed services upon other frequency bands. It is reasonable- or at the very least worthwhile for purpose of discussion- to assume that at least one additional licensed service may be affected within any given set of geographical boundaries, particularly when those services utilize mobile operations. This is of particular import since the Commission fails to properly treat the issue of interference to licensed mobile operations within the NPRM. As will be demonstrated below, there is no particular distinguishing quality between the common technologies used by the amateur radio service and those utilized by other services such as public safety and CII. In a mobile operating environment, units routinely operate along the nation's roadways, alongside which typically run medium-voltage power lines. If these power lines are used for the transport of BPL services, there is a certain risk of interference to these mobile units which may be high, and which would be difficult or impossible to mitigate by the proposed technologies due to the transitory nature of the licensed mobile units.

9. The Commission has incorrectly concluded that these power lines do not pose a risk of radiation (NPRM at ¶ 36): such a conclusion can only be made contrary to the laws of physics and the established body of knowledge related to the principles of RF transmission, as will be demonstrated below. Harmful interference radiating from these lines cannot, using the proposed mitigation technology, be remedied in a real-time fashion adequate to compensate for the movements of a mobile unit. Considering these facts, there can be no conclusion other than that the ubiquitous presence of medium-voltage power lines throughout the nation, if used for the support of Access BPL technology as contemplated within the NPRM, poses a risk of harmful interference to multiple licensed services within the portion of the spectrum targeted for use by

most Access BPL systems.

10. The Commission has stated that “a properly designed and operated BPL system will pose little interference hazard to non-amateur services such as aeronautical, maritime and public safety.” (NPRM at ¶ 37). In this regard, the Commission appears to assume that public safety systems (and, presumably, other types of licensed incumbent systems) are less susceptible to interference from BPL than are amateur radio systems because public safety systems typically are designed to “receive a signal level significantly above the noise floor,” while amateur systems use “high-sensitivity receivers to receive signals from transmitters often thousands of miles away.” (*Id.*). However, particularly with regard to systems operated by CII and public safety entities as compared to amateur radio systems operating in similar portions of the spectrum, the design and installation of these systems are virtually identical.<sup>2</sup> Contrary to the Commission's assertions, such systems regardless of service do not necessarily operate significantly above the noise floor particularly when mobile or portable operations are conducted at or near the fringe of the licensee's service area. Under such circumstances, the potential risk of interference from BPL to each type of station would be expected to be similar, and in the case of mobile or portable units operating at weak signal levels near the fringe the impact of otherwise tolerable interference would be more damaging.

11. I also believe that the Commission may have underestimated the potential cumulative interference effects of multiple BPL devices transmitting simultaneously within a given

---

<sup>2</sup> For example, a PLMRS station operating on 49 MHz with a vertical whip is analogous to an amateur station operating on 50 MHz in a similar installation. Similarly, an analog would exist between an amateur station operating USB with a vertical antenna on 21 MHz and a maritime coast station operating similarly on 22 MHz. In the case of 5 MHz, there is a direct and regulated correlation between systems operated by Federal entities and systems operated by amateur licensees. In all cases, these systems would be expected to operate reliably at signal levels near the noise floor.

geographic area. (See NPRM at ¶ 36). Given the Commission's recent analyses and discussions with regard to the "interference temperature" approach to measuring and managing interference,<sup>3</sup> as well as relevant observations included within the NTIA Study, the agency should immediately recognize that the operation of multiple BPL devices within a specific region is likely to create an aggregate or cumulative effect that may increase the potential for harmful interference to licensed services, which may extend beyond that specific region under certain circumstances.

12. The Commission states that "hundreds of kinds of unlicensed devices are successfully operating under the current Part 15 limits without causing harmful interference to licensed operations" (NPRM at ¶ 34). I respectfully disagree with the Commission regarding this conclusion. Within my role as an RF Engineer for CII companies and as a licensed operator in the Amateur Radio Service, I have in the past frequently mitigated, and continue to mitigate, interference from Part 15 devices to licensed systems for which I am responsible. Such interference is frequently observed from switching power supplies in computing equipment or television receivers, from computers themselves, from various appliances, etc. I have broad experience with the use of systems operating in the ISM bands, where unlicensed Part 15 devices regularly interfere with other unlicensed Part 15 devices and with licensed services in those bands (such as Amateur). In the case of interference to licensed services from Part 15 devices (and, in fact, for the reverse where Part 15 devices receive interference from licensed services) it has long been the practice of the Commission to encourage licensees to resolve such interference problems without Commission involvement. This is especially true in the case of

---

<sup>3</sup> See In the Matter of Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands, Notice of Inquiry and Notice of Proposed Rulemaking, ET Docket No. 03-237 (2003).

Amateur Radio licensees, where the promotion of “goodwill between neighbors” is in the best tradition of the service. I suggest that the Commission may have overlooked such routine practice on the part of licensees in all services and thus has incorrectly assumed that those few reported cases (which have actually required intervention by the Commission) are completely representative of the actual interference to licensed services by Part 15 devices.

13. The Commission has indicated an expectation “that, in practice, many amateurs already orient their antennas to minimize the reception of emissions from nearby power lines” (NPRM at ¶ 35). Presumably, this assumption extends to other licensed entities as well. I assert from broad experience that Amateur licensees utilize this practice occasionally on low HF and MW frequencies for specialized communications upon those bands, and that such a practice is otherwise typically encountered only during a period while an Amateur licensee is attempting to identify and seek mitigation for harmful interference emitting from a power line (or some other source). This mitigation technique is practiced rarely, if at all, by other licensed services operating upon the spectrum under discussion. In any event, *it is not reasonable to argue that any licensee’s individual effort to mitigate harmful interference on their own initiative might justify the continued existence of such interference or the permissiveness of such harmful interference in general.* Further, I suggest that the Commission should observe that harmful or damaging interference is best interpreted as any interference which impairs the reception of a signal which would otherwise be capable of delivering useful information: under Part 15, it is clear that regardless of the actual level of any such interference relative to permissible limits any BPL device operating under Part 15 must *completely* mitigate harmful interference or cease operation if it creates such harmful interference to the operations of a licensee. I applaud the FCC’s endeavor to identify mechanisms for such mitigation but will question their potential

effectiveness, as will be discussed below.

14. I also applaud the FCC's conclusion that Access BPL is not a traditional point-source emitter (NPRM at ¶ 36), as this finding forms the foundation for technical argument related to the behavior of the power line infrastructure supporting BPL. However, I strongly disagree with the Commission's conclusion in the same paragraph to the effect that power lines will *not* "act as . . . transmission lines all radiating RF energy along their entire length" (NPRM at ¶ 35). This is in conflict with the laws of physics and the established body of knowledge relative to the art and science of the transmission of RF power. At least one recognized reference treats directly with medium voltage power lines as a form of balanced line, and provides guidance in lay terms clearly demonstrating that even assuming that such a line is differentially fed and completely balanced, such a power line will exhibit a propensity to radiate upon the portion of the RF spectrum contemplated for BPL.<sup>4</sup> However, similar proofs are available in more complex form from a variety of electronic engineering texts: the significance of line spacing to wavelength relative to undesirable radiation from the line is well known by those familiar with the art of transmission line design. Especially at the higher frequencies of the spectrum under discussion, power lines (whether balanced or unbalanced) *will* radiate. In the event of

---

<sup>4</sup> See BLAKE, LAMONT V., "Transmission Lines and Waveguides", 1969 John Wiley and Sons, New York, pp 28-32. This academic reference states that "if line spacing is appreciable compared to the wavelength, or if there is unbalance, radiation will occur. It will be negligible if  $s / \lambda$  is of the order of 0.01 or less, but it will be appreciable if  $s / \lambda$  is 0.1 or greater, or if there is appreciable unbalance". From Blake's assertion, it is apparent that in the case of a hypothetical BALANCED parallel power transmission line spaced at approximately 2 meters between conductors (allowing for a nominal .95 VF for close-spaced open wire line, 1) radiation would be negligible for most of the AM broadcast band and below, 2) radiation would be present to some (increasing) degree between approximately 1.4 MHz and approximately 14 MHz, and 3) radiation would be (increasingly) significant above approximately 14 MHz. Therefore, it is reasonable to extrapolate that within a range of spacing of 3' to 9', the general effect will hold true- that regardless of the precise spacing even a PERFECTLY BALANCED, DIFFERENTIALLY FED power line will radiate "less" on MW frequencies & below, "some" on lower HF frequencies, and "considerably" on upper HF and VHF frequencies. Typical power transmission lines are rarely perfectly balanced, and may not be differentially fed in all contemplated BPL designs: in such cases, the propensity for power line radiation would be greater.

unbalance or at an impedance discontinuity, the propensity to radiate could increase. The Commission may or may not be correct in assuming that the primary source of emissions will be “the individual couplers, repeaters, and other devices” (NPRM at ¶ 35) but the emissions radiating from the power line infrastructure cannot be summarily discounted. If not adequately mitigated, this propensity of the power line infrastructure to radiate, particularly that part of the infrastructure which is not underground, has a significant potential to cause harmful interference to licensed incumbent services operating between 30 MHz and 50 MHz, especially in the case of mobile stations. To some degree, the effect of such harmful interference might be lessened by reducing the permissible level of BPL emissions under Part 15, as suggested in the NTIA Study. However, the uncertainty of site-specific conditions, as well as additional uncertainty regarding the specific technical design of the licensed station(s) impacted by harmful interference, prevents the reduction of the level of permissible BPL emissions alone from providing the necessary assurance that licensed services will remain free from harmful interference. The only viable mitigation technique that would provide such complete assurance- other than the obvious but impractical method of replacing the open power line with shielded cable- is the avoidance of all frequencies for which the line radiation is other than minimal: in other words, avoidance of the greater part of the spectrum under discussion. This technical quandary alone calls into question the wisdom of contemplating further use of the HF and VHF portions of the spectrum for the purpose of Access BPL: additional considerations, such as the potential for ubiquitous licensed services (such as the Amateur Radio Service) to frequently interfere with BPL systems to the detriment of subscribers, make such contemplation highly questionable . Instead, I suggest that the Commission acknowledge the pitfalls inherent with

---

deployment of Access BPL upon the spectrum under discussion, and instead permit operation of Access BPL only upon selected microwave bands where the potential for harmful interference to licensed services (and conversely, from licensed services) is less due to the propagation characteristics of those frequencies in combination with the limited number of incumbent users who are reliant upon reliable reception of signals near the noise threshold and who would be within the effective range of the BPL emissions. At least one Access BPL manufacturer utilizes technology which operates, purportedly in a reliable manner, upon the microwave portion of the RF spectrum.

15. It is in the best interest of the general public (as potential subscribers to BPL services) that the Commission permit BPL operations only upon portions of the RF spectrum, preferably above 2 GHz, *where the risk of interference by licensed services to BPL subscribers is minimal*. In the event that the Commission elects to permit BPL operation at frequencies below 2 GHz regardless of advice to the contrary, I urge that the Commission mandate the installation of high quality notch filters (appropriately placed) throughout BPL systems in order to effectively block BPL operations upon frequencies assigned to the Amateur Radio Service and the Citizen's Band Service, the logical presumption being that the ubiquitous presence of fixed, portable, and mobile transmitters *on these frequencies in particular* would otherwise be detrimental to the reliability and usefulness of BPL services (which would not be in the public interest). While it is true that BPL systems operate under Part 15 and must accept interference, it would not be not responsible to permit the deployment of BPL systems in a manner which might lead to the addition of an inherently fragile or unreliable component to the nation's broadband infrastructure.

16. The Commission touched upon the subject of In-House BPL and CCS (NPRM at ¶ 47)

seeking comment regarding measurement requirements. I tentatively agree with the Commission's proposal regarding the path forward. However, I propose that similarly as for Access BPL, these systems also be authorized for operation only above 2 GHz, or if authorized for operation below 2 GHz that the frequencies authorized for the Amateur Radio Service and Citizen's Radio Service be completely avoided by use of properly applied notch filtering (for the same reason of improved reliability to the consumer as in the case of Access BPL).

**B. BPL Systems May Interfere with Emergency Notifications from the Emergency Alert System in the AM Broadcast Band**

17. The Commission seeks comment as to whether Access BPL would in some instances operate in the AM broadcast band (from 535 to 1705 kHz), and whether specific conducted measurements are needed in such situations. Setting aside (for purpose of discussion) the existing regulatory requirement to prevent harmful interference to licensed stations, another important priority must be considered. It is not in the best interest of the general public and the nation to permit BPL operation on the AM Broadcast band, as such operation would have the potential to interfere with the reception of emergency information from the Emergency Alert System (EAS). Such a potential for interference is especially true in the case of motorists, who due to the proximity of medium-voltage power lines to the roadways of our nation, are at increased risk for ubiquitous damaging interference to signal reception: and motorists in particular are often those most reliant upon the reception of such emergency information (for example, in the case of severe weather alerts). I urge the Commission to mandate that BPL systems avoid the AM Broadcast band, possibly by the application of quality high-pass filters at all ports of all BPL transmission equipment, and that appropriate in-situ test procedures be developed to assure that BPL systems installed in the field do not inadvertently radiate either

BPL transmissions or spurious emissions upon the AM Broadcast band.

**C. Sensitive Frequencies and Critical Services Require Coordination or Protection, And a Mechanism is Required to Reimburse Incumbents for Related Costs**

18. The Commission requests comment “whether any additional measures are needed to protect particular operations, such as public safety” (NPRM at ¶ 37). The Commission sets forth as an example a hypothetical requirement for Access BPL to coordinate with public safety agencies using the HF band (and presumably other bands, such as VHF) for wide area public safety communications. Under any circumstances, but particularly considering the current geopolitical situation and our nation’s need for stalwart mechanisms to assure Homeland Security, frequencies used for emergency purposes must not be encumbered by harmful radiation. In particular, most such services have set aside specific frequencies for intra-service or inter-service emergency operations, such as the oil spill frequencies utilized by the Petroleum industry, or the set of frequencies identified within by the NTIA as “sensitive or protected frequencies in the 1.7 to 80 MHz Band” (NTIA Study at Vol. 1, Sect. 4.6). I urge the Commission to mandate that BPL systems completely avoid such sensitive frequencies. Additionally, I urge that the Commission require BPL operators to coordinate with all public safety and CII entities operating within their respective region(s) to assure avoidance of any local or regional frequencies which are similarly sensitive. Due to the potential cost burden to incumbent public safety and CII licensees, I propose that the FCC provide an appropriate compensation mechanism whereby the BPL operator(s) would reimburse the incumbent licensee(s) for any costs associated with said coordination process. Such a compensation mechanism is consistent with similar protections which the Commission has provided to incumbent licensees in the past, where the encroachment of new services created a risk of

harmful interference to incumbent licensees. Further, in the past incumbent licensees have been forced to relocate due to unacceptable risk of interference from encroaching services: I suggest that the Commission provide a compensation mechanism to enable the relocation of incumbent licensees, and particularly for public safety and CII entities, in the event that interference mitigation proves inadequate to resolve widespread impairments.

**D. Implementation of the Interference Avoidance and Mitigation Methodologies Proposed by the Commission May be Insufficient to Protect Licensed Services**

19. I generally support the Commission's proposals to require BPL systems and devices to incorporate certain adaptive interference avoidance technologies (such as power reduction and frequency selection capabilities), as well as a shut-down feature and notification requirement. (See NPRM at ¶¶ 40-43). However, for a number of reasons, I am concerned that the contemplated requirements will prove insufficient to effectively prevent and mitigate actual interference when the BPL technology becomes widely deployed.

20. A number of potential pitfalls may arise relative to technical interference avoidance measures, both automatic and those requiring manual implementation by a BPL system operator. Although the contemplated technology or the BPL operator's personnel may be able to identify and select a "clear channel" (or range of channels) upon initiating operations, interference could nonetheless occur in instances where a licensee subsequently attempts to transmit or receive signals on that channel. Interference mitigation efforts could then be impeded by factors such as: (1) the licensee affected by harmful interference may be unaware of the interference, even where such interference is present at a sufficient level to effectively block communications (for example, in the case of a system receiving data transmissions over a muted receiver); (2) the licensee affected by harmful interference may find it difficult to determine the

nature and source of the interference without first initiating an on-site investigation by experienced technicians utilizing specialized test equipment; (3) the licensee receiving interference may be unaware of the source for current and accurate contact information for the BPL operator; and (4) if manual intervention is required, the BPL operator may be unable to immediately provide personnel to mitigate the interference.

21. In particular, I question the potential effectiveness of cognitive technology as a mitigation approach. This technology requires the BPL system to detect emissions from licensed incumbents and dynamically avoid occupied frequencies. This approach is likely to fail for the simple reason that no existing cognitive device (nor any pending improvement to the technology) has the capability to detect the presence of passive radio receivers listening for traffic, nor can they reliably detect weak incoming signals arriving at receivers, and thus cognitive technology is unable to determine whether the frequency is actually occupied by an incumbent licensee. Therefore, reliance upon this technology could result in the interruption of communications in-progress at a nearby receiver, or might prevent a subsequent transmitted signal from being received at the other end of the link. Cognitive technology is only practical for the limited case where a licensed incumbent is operating at a high transmit duty cycle on a simplex frequency with substantial effective radiated power in the direction of the cognitive BPL device. I contend that a high transmit duty cycle is not representative of typical operating practice for most incumbent licensees upon the portion of the spectrum under discussion. Instead, it is more often the case that licensed stations spend the majority of their time listening for activity and transmitting only when necessary to accomplish their communications. I also contend that some systems may operate in a duplex or half-duplex mode where transmit and receive frequencies differ. Due to this failure of cognitive technology to avoid an apparently

unoccupied frequency which is actively occupied by an incumbent licensee, the potential effectiveness of cognitive BPL devices in general is highly questionable.

22. The Commission also proposes to require that BPL devices incorporate a shut-down feature that would deactivate any BPL devices found to be causing harmful interference. (NPRM at ¶ 42). I support such a requirement and urge the Commission to specify in its rules that BPL providers must immediately implement the device shut-down feature upon receiving a report of interference from an incumbent licensee, rather than delaying the interference mitigation by proceeding to investigate and confirm prior to the implementation of device shut-down. This is especially critical for public safety and CII entities, whose ability to assure the public safety may be compromised by undue mitigation delays. I also generally support the Commission's proposal that BPL system operators submit information on their systems to an industry-operated entity (NPRM at ¶ 43), but observe that while such a body of information would undoubtedly prove useful for mitigation, it does not in itself serve to avoid harmful and unnecessary interference to incumbent licensees and thus is a feature, not a solution.

**E. Stringent Procedures Should be Implemented to Determine Compliance of Emissions from BPL Systems**

23. Adoption of the mitigation proposals in the NPRM may prove useful towards the reduction or mitigation of harmful interference, but these techniques are by themselves inadequate to assure that harmful interference to licensed incumbents will be avoided. Further, the Commission proposes measurement guidelines that are fundamentally flawed and will not serve to assure compliance even with existing emissions limits under Part 15. As suggested by the NTIA Study, more stringent and technically sound procedures for measuring BPL emissions are required, and permissible emission limits for BPL systems should be reduced. The NTIA

Study makes a strong case for such reduction of permissible emission limits as applied specifically to BPL systems, and I strongly recommend that that Commission endorse and act upon the NTIA's recommendations to reduce permissible signal levels for BPL under Part 15.

24. Recognizing that BPL systems are not comprised of discrete point-source emitters, and that the power transmission line will effectively radiate power at potentially considerable levels when utilized for transport of BPL signals, I recommend that the Commission require the installation of blocking filters suitable to prevent BPL signals from being propagated upon any segments of the power transmission system, including residential power drops, over which the transport of BPL signals is not specifically intended. Such an approach would limit the quantity of infrastructure which might unintentionally transport and radiate BPL signals, simultaneously reducing the opportunity for interference in and around said portion of the infrastructure as well as reducing the quantity of the power transmission system which must be tested for BPL emissions compliance under a revised Part 15 (and thus reducing the overall burden upon the BPL operator to test infrastructure and subsequently assure continued compliance).

25. The Commission proposes that BPL systems be measured for compliance *in-situ* at a minimum of three "underhead" and three overhead locations. (NPRM at ¶ 45 and Appendix C). While I agree that compliance measurements should be made *in-situ* I strongly disagree with the contemplated use of representative locations. Because each BPL field installation will be unique in some fashion (whether due to the precise physical geometry of the infrastructure or to characteristics of the surrounding environment), measurement at a representative site- regardless of how well planned- cannot assure compliance of BPL devices installed outside of the test environment. I urge the Commission to mandate that all deployed BPL systems be tested *in-situ* following installation for compliance with revised Part 15 emission limits, and that any

subsequent changes at a site (for example, as the result of change due to maintenance) require the repetition of such compliance testing in order to assure that such changes do not inadvertently result in an accidental increase in peak emissions. Such an approach is consistent with the Commission's existing rules governing site-specific compliance for licensed services; although BPL will not be a licensed service, the risk of site-specific conditions that might result in non-compliance (and, hence, interference) is substantial enough to warrant site-specific measurements for all elements of BPL systems installed throughout the nation.

26. I further recommend that compliance measurements be made continuously throughout the Spectrum being employed by the BPL operator rather than only at mid-band frequencies<sup>5</sup> as suggested by the Commission. Further, measurements should be made for radiation in both electric and magnetic field(s) surrounding all potentially radiating elements and devices. I further recommend that the Commission mandate the specific design and dimensions of standardized antenna and feedline sets to be used for measurement of BPL emissions, of a design providing assurance of the detection of peak signal levels whether such occur in an electric or a magnetic field, and determine a standard graph depicting the gain behavior (in free space) of each antenna design throughout the entire range of frequencies being employed by BPL. Measurements should then be continuously taken across the entire range of spectrum used by BPL (including any frequencies avoided by the system) using a calibrated spectrum analyzer in order to detect peak emissions. The measurements should be repeated for both electric and magnetic fields, and for both vertical and horizontal polarization. The standardized charts reflecting the standard antenna calibration offsets across the spectrum provide reference to

---

<sup>5</sup> While measurement at a mid-band frequency might be appropriate for a point-source emitter, the FCC recognizes in the NPRM that BPL does not entail traditional point-source emissions. (NPRM at ¶ 36).

determine whether the BPL installation complies with revised Part 15 requirements as each antenna type is applied during testing. Due to the broad range of frequencies utilized by BPL, such an approach is essential to ensure that accurate measurements are obtained.

27. I further recommend that measurements as recommended above be taken 1) along the complete length of the power transmission lines in those plane(s) perpendicular to the earth which are alongside the power transmission lines, 2) in the plane parallel to the earth and underneath the power transmission lines, and 3) in the plane parallel to the earth and above the power transmission lines. For each of the above, all measurements should be made at a specified test distance sufficient to ensure safety while permitting accurate determination of emission compliance. All measurements should be made along each plane in a continuous manner suitable to detect the peak signal level which might be emitted upon any possible lobe, as a narrow, high-gain lobe might exist at any given intersection with a plane. For example, measurements for “1)” above should be made at continuously varying heights beginning at 1 meter above ground level and extending to an appropriate height above the height of the power transmission line, and continuously measured in this manner along the entire length of the line which is utilized for transport of BPL signals. Similar regimen should be developed for the other cases. Any general measurements such as those contemplated by the Commission, when taken without any consideration of for the propensity of the BPL system to form peak lobes which might exceed emissions limits, are inadequate and can provide no assurance of compliance.

**F. BPL Systems May Be Subject to Other Factors Which Could Increase the Potential for the Generation of Harmful Interference, and The Commission Should Await Phase II of the NTIA Study Before Concluding This Proceeding**

28. The Commission should recognize that there are other factors that could lead to the incidence of harmful interference which have not be adequately explored. The propensity of the power transmission lines to radiate could lead to harmful interference if the radiation propagates in other than ground wave mode- for instance, if a peak lobe forms at a low takeoff angle suitable for sky-wave propagation or if a peak lobe forms at a high takeoff angle suitable for Near Vertical Incidence propagation. Under such conditions, radiated BPL emissions even at low signal levels could cause interference to stations far outside their area of operation, not only risking potential interference to licensed incumbents within our borders but possibly interfering with communications outside of those borders in violation of international agreements. Further, little or no consideration has been given as yet regarding compliance to some reasonable standard for spurious emissions over BPL systems: given the Commission's own knowledge regarding spurious emissions, the potential of such emissions to cause harmful interference outside of the planned spectrum occupied by a BPL system cannot be discounted. No consideration has been given for the potential generation of intermodulation interference when BPL signals mix with signals from other transmitters or within receivers: the potentially ubiquitous presence of BPL could bring BPL signals into adequate proximity with other devices to cause harmful interference on intermodulation sum and difference frequencies. Such a situation might easily occur where BPL signals closely approach, for example, a densely populated tower site supporting numerous transmitters. It is well accepted by those knowledgeable in the art and science of RF communications that interference caused by intermodulation can be difficult to isolate and identify, and at times even more difficult to

remedy. The NITA Study, during Phase I, did not address these and other important issues. However, the NTIA did indicate that such considerations would be dealt with in Phase II. Should the Commission elect to conclude this proceeding prior to the release and subsequent evaluation of the NTIA's Phase II Study, I propose that a set of appropriate interim regulations be adopted under the premises discussed herein, to remain effective until such time as the NTIA completes and releases Phase II of their Study and the Commission makes appropriate retroactive modifications to their regulations regarding BPL systems under Part 15, said interim regulations to require (if necessary) remedial treatment of any BPL systems deployed earlier that do not meet the requirements of the subsequently modified regulations.

**G. The NTIA Study, Phase I, Should be Incorporated Within the Official Record of This Proceeding**

29. The observations, assertions, and proposals herein (as related to the subject of potential interference to incumbents) are generally supported by the findings of the NTIA Study, Phase I. Further, this study treats the issue of potential interference from BPL systems in a well considered, comprehensive, and technically correct manner, and contains accurate technical material that will prove invaluable to the Commission during its deliberations. Therefore, I urge the Commission to include the entire NTIA Study and any related documents prepared by the NTIA in the official record of this proceeding and to treat them accordingly.

**III. CONCLUSION**

30. I appreciate the opportunity to comment in this important proceeding and urge the Commission to recognize that the expansion of BPL operations will present potential risks as well as potential benefits. In its efforts to identify and remove regulatory barriers impeding the

ability of BPL to enter the competitive marketplace, the Commission should keep in mind the priority status of licensed incumbents operating in the spectrum under discussion and the valuable services that they provide to our nation. For the reasons discussed herein, the Commission should consider whether approval of BPL operations upon any portion of the spectrum below the microwave frequencies would truly be in the best interest of the general public, or whether operation in the microwave portion of the spectrum would instead provide inherent remedies for the shortfalls identified herein and thus satisfy the Commission's intent to facilitate deployment of the technology. However, should the Commission determine that BPL operations below 1 GHz are acceptable, then I propose that the Commission consider and act upon the premises expressed herein in order to reduce the potential for interference to incumbent licensees. Especially, I urge the Commission to await the completion and release of Phase II of the NTIA's Study relative to potential interference from BPL, in order to responsibly assess the potentially harmful effects of propagation, spurious emissions, intermodulation interference, and other factors related to the operation of BPL systems.

**WHEREFORE, THE PREMISES CONSIDERED**, I, Ronald K. Wray, respectfully submit the foregoing Comments and urge the Federal Communications Commission to act in a manner consistent with the views expressed herein.

Respectfully submitted,

**Ronald K. Wray**

1320 Carriage Run West  
Conroe, TX 77384  
936 273 9357  
eurodiver@aol.com

Dated: May 2, 2004