

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)	
)	
CARRIER CURRENT SYSTEMS)	ET Docket No. 03-104
INCLUDING BROADBAND OVER POWER)	
LINE SYSTEMS)	
)	
AMENDMENT OF PART 15 REGARDING)	ET Docket No. 04-37
NEW REQUIREMENTS AND)	
MEASUREMENT GUIDELINES FOR)	
ACCESS BROADBAND OVER POWER LINE)	
SYSTEMS)	

To: The Commission

**REPLY COMMENTS OF ARRL,
THE NATIONAL ASSOCIATION FOR AMATEUR RADIO**

ARRL, the National Association for Amateur Radio, also known as the American Radio Relay League, Incorporated (ARRL), by counsel, hereby respectfully submits its reply to certain comments filed in response to the *Notice of Proposed Rule Making* (the Notice), FCC 04-29, released February 23, 2004, 69 Fed. Reg.12612 *et seq.* The Notice proposes to amend Part 15 of the Commission’s rules governing unlicensed radio frequency (RF) devices to adopt new requirements and measurement guidelines for carrier current systems that provide access to broadband services using electric utilities’ power lines, known as Broadband Over Power Line (BPL) technology. The reply comment date in this proceeding was extended to June 22, 2004 by an *Order Granting Extension of Time* released May 27, 2004 (DA 04-1552). Therefore, these reply comments are timely filed. For its reply comments, ARRL states as follows.

I. Evaluation of the Comments Generally

1. There were 1224 comments filed in response to the Notice, and at this writing, more than 1400 comments have been filed overall. The overwhelming majority of these comments oppose Commission authorization of BPL due to interference concerns. Some of these opposing comments recite personal experience with interference from BPL test sites that either has not been or cannot be resolved. As discussed below, the Commission is obligated by the Administrative Procedure Act to look for fire where it is shown a good deal of smoke. Here, there is far more than smoke in the record. ARRL's comments filed in response to the Notice in this proceeding argued that the proceeding is ill-timed and constitutes a blind rush to judgment on the part of the Commission. The comments in this proceeding provide ample validation for this argument. ARRL, and others concerned about the apparent, predictable and currently experienced interference from BPL systems to Amateur Radio and other licensed services are convinced that this proceeding has become highly political and insufficiently rooted in technical analysis. ARRL's comments at the Notice of Inquiry (NOI) stage of this proceeding attempted to create an objective basis for a fair and balanced analysis of the interference potential of BPL. ARRL offered for review and criticism a series of technical analyses, including calculations of interference potential, and showings of the extent to which Radio Frequency (RF) energy will radiate from power lines and cause interference to licensed radio services, including public safety and critical infrastructure communications.¹ The Commission ignored these

¹ The crux of the difference between the comments of the BPL proponents and ARRL's comments, both at the NOI stage and in the comments in this proceeding, is that the BPL proponents offered little more than vacuous assurances that BPL would not cause harmful interference. ARRL provided calculations demonstrating that 30 uV/m fields measured 30 meters from the source carried on overhead power lines would in fact cause severe interference. ARRL demonstrated that the interference will be present for a considerable distance along a power line. ARRL provided empirical field tests that showed a strong noise level from BPL trial areas, masking all but the strongest local signals, and showing that this level did not

in the instant Notice, as did the BPL proponents in their comments. The latter, acting as if the ARRL studies were not in the record, merely claimed that ARRL's interference concerns were "unsubstantiated." Ironically, with but one exception addressed herein, BPL proponents offered no engineering analyses themselves, either to rebut or to establish *de novo* what the interference potential of BPL actually is. The Commission committed the same error, merely quoting both arguments but analyzing neither on a technical basis, and then forming bare conclusions in the Notice without the slightest justification offered. This is insufficient in administrative rulemaking.² The Commission

diminish significantly as a test station was driven in a vehicle on roadways along the power lines. It is impossible on the record to conclude, as the Commission attempts to do in the Notice in this proceeding, that "the likelihood of such harmful interference is low under the current limits." (See the Notice, at Paragraph 33).

² Section 553(c) of the Administrative Procedure Act provides, in pertinent part:

“After notice required by this section, the agency shall give interested persons an opportunity to participate in the rule making through submission of written data, views, or arguments... After consideration ... the agency shall incorporate in the rules adopted a concise general statement of their basis and purpose.”

In *Alascom v. F.C.C.*, 55 Rad. Reg. 2d (P&F) 769 (1983), a case involving a decision of the Commission (FCC) to reallocate radio spectrum for Digital Electronic Message Service (DEMS), the U.S. Court of Appeals for the District of Columbia Circuit stated in a footnote (citing substantive cases) that:

The FCC's treatment of the issue can, at best, be described as terse. Furthermore, we note that the Commission's method in this case of offering generalized justifications of its decisions often without discussing the opposing comments received on each issue, and then appending to the Order a separate unpublished summary of comments received containing no response to any of the comments, makes it difficult for a reviewing court to determine whether the agency has truly evaluated the comments it has received. Certainly the Administrative Procedure Act's requirement that an agency "consider" the public comments received, see 5 U.S.C. §553(c) (1982) ("After consideration of the relevant matter presented, the agency shall incorporate in the rules adopted a concise general statement of their basis and purpose."), must mean something more than a mere listing of abstracts of the comments totally unintegrated with the Order itself. See, e.g., *Rodway v. United States Dep't of Agriculture*, 514 F.2d 809, 817 (D.C.Cir.1975) (basis and purpose statement must respond in a reasoned manner to comments received, explain how the agency resolved the significant problems raised by the comments, and show how that resolution led the agency to the ultimate rule); *American Medical Ass'n v. Mathews*, 429 F.Supp. 1179, 1204 (N.D.Ill.1977) (major issues must be identified and agency reaction to those issues explained)." *Alascom* Rad. Reg. 2d 769, 778.

cannot simply draw unsubstantiated conclusions on the issues presented in the notice and comment process. Such conclusions would be arbitrary, capricious and an abuse of discretion. *Office of Communication of United Church of Christ v. FCC*, 707 F. 2d 1413 (D.C. Cir. 1983). Any decision in this proceeding must be supported by substantial evidence. *California Citizen's Band Association v. U.S.*, 375 F. 2d 43 (9th Cir. 1967), *cert. denied* 389 U.S. 844 (1970).

2. The situation has now worsened. The BPL test sites have, to greater or lesser extents, been shown to be substantial sources of significant interference. There are dozens of complaints filed with the Commission, both at the Enforcement Bureau and with the Commission's Experimental Licensing Division, Office of Engineering and Technology, about these test sites (See, www.arrl.org/~ehare/bpl/complaints.html). The Commission has, as of this writing, ***adjudicated not a single one***, and has ignored repeated requests from licensed radio amateurs for even a confirmation of receipt of their complaints! In some cases, radio amateurs living in or adjacent to BPL test site communities cannot utilize the High Frequency amateur allocations, or the majority of them, from their residences because the BPL test site operation causes preclusive noise.³ Poignant examples of these are the unadjudicated complaints filed by Mr. Tom Brown of Wake Forest, North Carolina of severe interference from the Progress Energy BPL test site in

The required statement of basis and purpose contained in 5 U.S.C. §553(c) is not meant to be an abstract explanation addressed to an imaginary complaint but is intended, rather, to respond in a reasoned manner to the comments received during the comment period, to explain how the agency resolved the issues raised by the comments, and to show how that resolution led the agency to the ultimate rule. See e.g. Rodway v. USDA, 514 F.2d 809 (1975).

³ The Commission is fond of relying on the non-interference provisions of Section 15.5 of the Commission's rules as a cure-all for Part 15 interference to licensed services. Sweeping BPL interference complaints under the Commission's rug, coupled with the BPL industry's bad faith denial that there are instances of interference points up the folly of the argument that enforcement of Part 15 rules would be available to provide interference relief in these cases.

Wake County, North Carolina,⁴ which uses as a vendor Amperion, Inc., and the unadjudicated (but amply documented and supported) complaint filed by Mr. James Spencer regarding the Cedar Rapids, Iowa BPL test site.⁵ To be sure, some BPL test sites are worse interference sources than others, and perhaps some types of BPL systems under certain configurations and limited operating parameters could be permitted to operate. However, BPL proponents, including the Power Line Communications Association (PLCA) are still contending alternatively that (1) there are no interference complaints; (2) those complaints of interference which have been made are not *bona fide*; or (3) the interference reported does not constitute "harmful" interference and therefore the BPL provider has no obligation to remedy it. ARRL is certainly willing to have the complaints of radio amateurs of interference from BPL test sites carefully analyzed. What ARRL is unwilling to tolerate is the continuation of the Commission's sweeping of these

⁴ Mr. Brown has filed complaints with the Commission since prior to April, 2004, without any substantive response. This pertains to Experimental License WD2XCA, file number 0011-EX-PL-2003 granted February 10, 2003. This facility causes massive interference to mobile amateur radio stations within the authorized 20-mile radius of reference coordinates. All experimental authorizations are premised on non-interference to licensed radio services. Entire frequency bands are rendered unusable by this system, yet the Commission has taken no action for months to resolve it. Nor have any of Progress Energy's efforts (initiated in fits and starts) to resolve this interference been productive, and the system continues to operate.

⁵ This case in particular illustrates fundamental incompatibility between BPL and Amateur Radio. Harmful interference has been suffered by Mr. Spencer, the licensee of Amateur Station W0SR, at his Cedar Rapids, Iowa residence (3712 Tanager Dr. N.E., Cedar Rapids, IA 52402-3349) for approximately three months, since the BPL system commenced operation in his area. Since March 30, 2004, Alliant Energy, the operator of the BPL system, has been aware that the system has been causing harmful interference. Alliant has taken steps to try to resolve it, but these efforts have failed. Despite repeated requests from Mr. Spencer, Alliant has refused to cease operation of the system, and has continued to operate it with knowledge that the operation has caused harmful interference in violation of Section 15.5 of the Commission's Rules. This interference is, therefore, willful and constitutes malicious interference in violation of Section 333 of the Communications Act of 1934, as amended.

Mr. Spencer, a registered professional engineer, immediately notified Alliant Energy of the problem upon commencement of the system's operation, and cooperated with its fruitless efforts to resolve the interference. This case was referred to the United Power Line Council (UPLC), which had asked that ARRL refer to UPLC interference cases not satisfactorily resolved by a utility. This was done in Mr. Spencer's case on May 20, 2004. Following additional communication, including a telephone conference call where UPLC's counsel heard the interference for himself, in real time, from Mr. Spencer's radio receiver, ARRL asked UPLC to disable the BPL system within ½ mile of Mr. Spencer's residence, unless and until other solutions were found. It is unclear what UPLC has done with respect to this, but Alliant Energy has done nothing at all. The interference continues 24 hours per day, seven days per week.

complaints "under the rug", which is exactly what has happened in this proceeding. The complaints are at the Commission⁶ and the Commission is obligated to take a fair look at them before any action is taken in this proceeding.⁷ Its zeal to permit anything that might possibly constitute a competitive broadband delivery mechanism cannot overwhelm its root obligation under the Communications Act to prevent interference to radio communications.

3. The Commission has undertaken its own measurement of certain BPL test sites. However, it has refused to make those studies, or the results of them, public. It has denied ARRL's Freedom of Information Act request for copies of those studies.⁸ Given this, ARRL is of the preliminary view that the Commission has prejudged this proceeding. It is suggested, in light of the comments in this proceeding to date; because of the procedural irregularities in this proceeding; and because of the absolute practical impossibility of returning Pandora to the Box at a later date if BPL systems are deployed, that a fresh look at the technical issues be taken with respect to BPL. The presumptions, prejudgments and preconceptions that the Commission has brought to the table in approaching this proceeding should be abandoned. Allowing BPL without further study,

⁶ It is inexplicable that complaints about harmful interference to Amateur Radio Stations from BPL test sites are referred to OET instead of being handled in the usual course by the Enforcement Bureau. ARRL has been informed by Enforcement Bureau staff that complaints from Amateur Radio operators are at OET's request forwarded to OET. There, they are apparently left to languish. No substantive response as to the status of those complaints has been received from either the Experimental Licensing Branch or any other office at OET.

⁷ That both the Commission and the BPL operators are content to allow BPL interference complaints to languish unadjudicated for many months at a time is testimony to the inadequacy of the Part 15 rules as a regulatory platform for BPL systems, and to the inability of radio amateurs to rely on either BPL providers or the Commission to address interference problems if BPL is authorized by the Commission.

⁸ On October 1, 2003, the Chief, Office of Engineering and Technology, denied ARRL's Freedom of Information Act Request for copies of interference studies related to BPL systems. Among the list of items not disclosed, but listed on the "Vaughn Index" in the denial letter were measurement data taken on a BPL test site of Current Technologies in Potomac, Maryland (undated); Emission measurement data taken on Current Technologies' Medium Voltage BPL system on April 22, 2003 (location unspecified) and BPL measurements in Allentown, PA, results of radiated emissions tests conducted May 19-22, 2003.

compatibility analysis and cooperative effort is irresponsible and "slap-dash" spectrum management. The entire spectrum management mechanism, both internationally and domestically, is premised on the integrity of the allocations process. The High Frequency (HF) bands require the ultimate in international and domestic allocation planning. The United States has very specific international treaty obligations in connection with its share of the custodial role in HF allocations, contained explicitly and repeatedly in the International Radio Regulations, to-wit:

RR 4.11. Member states recognize that among frequencies which have long-distance propagation characteristics, those in the bands between 5 MHz and 30 MHz are particularly useful for long-distance communications; they agree to make every possible effort to reserve these bands for such communications. Whenever frequencies in these bands are used for short- or medium-distance communications, the minimum power necessary shall be employed.

RR 4.12. To reduce requirements for frequencies in the bands between 5 MHz and 30 MHz and to prevent harmful interference to long-distance radiocommunications, administrations are encouraged to use, whenever practicable, any other possible means of communication.

RR 15.12. Administrations shall take all practicable and necessary steps to ensure that the operation of electrical apparatus or installations of any kind, including power and telecommunication distribution networks, but excluding ISM, does not cause harmful interference to a radiocommunication service and, in particular, to a radionavigation or other safety service operating in accordance with provisions of these regulations.

RR 26.4. Administrations shall cooperate in reducing interference in the frequency bands to which the standard frequency and time signal service is allocated.

Given these treaty obligations, each of which mandates the protection of long distance communications involving extremely weak received signal levels, the Commission must place the burden of justifying access to this unique and sensitive resource on services, whether licensed or unlicensed, seeking access to the HF spectrum. It cannot and should

not place the burden of proving incompatibility of interfering unlicensed RF sources in the HF spectrum on incumbent licensees. Nor should it place the burden of initiating interference resolution mechanisms on licensed HF services.

4. Surely enough, the explosion in unlicensed devices and systems has resulted in some successes and benefits for consumers. ARRL is well aware of the present Administration's goal of having universal broadband access by the year 2007. The current Commission is regulating with a view toward achieving that goal. It is indeed a worthy goal, and one that, ARRL believes, most radio amateurs would suggest is achievable and laudable. It is, however, not dependent on the present headlong effort to implement BPL at all costs. There are alternatives that will result in providing third, fourth or fifth broadband delivery mechanisms competitive with DSL and satellite-delivered broadband to provide the competitive benefits that the Chairman of the Commission seeks. BPL is not a necessary component of achieving either competition or universal broadband service. It is arguable that it is not even a practical competitive alternative. In any case, it cannot be implemented without severe limitations, according to the regulatory and allocations plan that exists, both internationally and domestically, for the HF bands.

II. The NTIA Report on BPL Interference

5. The National Telecommunications and Information Administration (NTIA) report on BPL,⁹ recently released, is of significant relevance to a fair and objective analysis of the technical interference parameters. The Commission refused to extend the comment date in this proceeding, requested in order to provide an opportunity for a meaningful analysis of this two-volume report, despite the fact that it directly addresses

⁹ NTIA Report 04-413, *Potential Interference From Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7 – 80 MHz*; Phase 1 Study, April, 2004 (cited herein as the NTIA BPL study, the NTIA Report, or the NTIA Study).

the issues in this proceeding and is of bellwether significance with respect to interference potential of BPL to licensed services. Fortunately, the NTIA Study is presented in a concise enough format that its Phase 1 conclusions are readily apparent and can be summarized simply. This is indeed a comprehensive study of BPL interference potential to Federal HF systems, and should be sufficient to cause the Commission to stop in its tracks and evaluate the BPL issue *de novo*. The fact that the Study is in two phases,¹⁰ with Phase 2 not yet concluded should be sufficient to cause the Commission to put this proceeding on hold until firm conclusions can be drawn from the Phase 2 results.

6. The technical basis for the NITA Study was sound. The Executive Summary of the Study states:

NTIA summarized technical and operating parameters of over fifty-nine thousand (59,000) Federal Government Frequency assignments in the 1.7 – 80 MHz frequency range...NTIA then defined representative radio systems for consideration in interference analyses: (1) a land vehicular receiver; (2) a shipborne receiver; (3) a receiver using a rooftop antenna (e.g. a base or fixed-service station); and (4) an aircraft receiver in flight. Federal communications require exceptional protection on frequencies amounting to about 5.4% of the 1.7-80 MHz frequency range...

NTIA executed three two-week measurement campaigns and used Numerical Electromagnetic Code (NEC) software to characterize BPL signal radiation and propagation. These efforts revealed that BPL systems generate the highest electric field strength near the BPL device for horizontal-parallel polarized signals. However, these systems generate peak field strength having horizontal-perpendicular polarization at small distances (e.g. less than 30 meters) from both the BPL device and power lines...

Using NEC, NTIA evaluated interference risks in terms of the geographic extent of locations where interference may occur to radio reception at four

¹⁰ Phase 1 of the Study defines interference risks to radio reception in the immediate vicinity of overhead power lines used by "access" BPL systems, and suggests means of reducing these risks and identifying techniques for mitigating local interference should it occur. Phase 2 of the NTIA Study will evaluate the effectiveness of NTIA's Phase 1 recommendations and address potential interference via ionospheric propagation of BPL emissions from "mature large-scale" deployments of BPL networks.

frequencies used by outdoor, overhead BPL systems conforming to existing Part 15 rules. Interference to land vehicle, boat, and fixed stations receiving moderate-to-strong radio signals is likely in areas extending to 30 meters, 55 meters and 230 meters respectively, from one BPL device and the power lines to which it is connected. With low-to-moderate desired signal levels, interference is likely at these receivers within areas extending to 75 meters, 100 meters and 460 meters from the power lines. Assuming that co-frequency BPL devices are deployed at a density of one per km² within a circular area of 10 km radius, interference to aircraft reception of moderate to strong [desired] radio signals within 40 km of the center of the BPL deployment area. However, at two of the four BPL frequencies considered with the assumed power lines, NTIA predicted smaller areas over which interference is likely.

NTIA Study, at v, vi.

7. The above summary of the procedures and findings of NTIA should be determinative of the severe interference potential of BPL to over-the-air radio services, and determinative of the undesirability of allowing BPL systems to operate in the HF spectrum. The interference potential of BPL systems to Amateur stations in close proximity to power lines is obviously as high as ARRL and its engineering contractors calculated and measured. The results of the NTIA study and ARRL's calculations and measurements previously filed are entirely consistent. Amateur stations in residential areas typically receive weak desired signals. NTIA's findings establish that fixed Amateur stations can expect to receive interference at distances of 460 meters (492 yards – almost the distance of five football fields) from a BPL device, even assuming that the device meets the radiated emission limits of existing Part 15 regulations. Worse, mobile stations, which would not be benefited by any interference mitigation techniques envisioned by the Notice in this proceeding, would be subject to interference up to 75 meters from a BPL device on the power line. This, and the fact that aeronautical stations are subject to interference from access BPL devices up to 40 km from the source of the

interference, should cause the Commission to stop this proceeding and to put BPL on hold.¹¹

8. The NTIA study also concluded that the existing Part 15 compliance measurement procedures for BPL systems results in a significant underestimation of peak field strength.¹² This is described as the “leading contributor to high interference risks.” Specifically, NTIA found that compliance measurements taken only around a BPL device and at heights below the elevation of the power lines may significantly underestimate the peak electric field. Further complicating interference prevention or resolution is the fact that the BPL electric field does not generally decay monotonically with distance from the BPL source as the measurement antenna was moved away from the BPL energized power line. Rather, localized peaks were noted. (*NTIA Study*, at p. 9-4). In fact, at one measurement location where a large number of BPL devices were deployed on multiple three-phase and single-phase Medium Voltage (MV) power lines, “appreciable” BPL signal levels, at least 5 dB above ambient noise, were observed beyond 500 meters from the nearest BPL energized power line. Therefore, it is clearly improper to view BPL devices as point-source radiators, as ARRL has contended all along, but contrary to the unsupported assertions of some BPL advocates. It is, however, quite reasonable to assume that the interference potential of BPL systems to fixed HF Amateur radio stations is on the order of 460 meters from the nearest BPL device.

III. The NTIA Comments in This Proceeding

¹¹ NTIA notes that, among the 59,000 Federal assignments in this frequency range are those which provide communications for homeland security, distress and safety, radioastronomy, radionavigation, and other critical functions. *NTIA Study* at page 9-2.

¹² *NTIA Study*, at vi.

9. Notwithstanding the overwhelming and determinative findings of the NTIA Study, NTIA tendered late-filed comments in this proceeding on June 4, 2004. These comments generally urge that the Commission proceed with the BPL rulemaking, and endorse the proposed radiated emission limits for BPL systems, though they suggest the adoption of certain means for reducing the risk of interference to authorized radiocommunication systems. This position is inconsistent on its face with the technical findings of the NTIA Study. How, given the prohibitively high interference potential and huge interference contours for virtually all types of HF radio facilities near power lines carrying BPL, can NTIA be heard to suggest in its comments that the Commission pursue BPL further? There are several answers. First of all, NTIA has, and must balance dual, and in this case conflicting, roles. It is, fundamentally, the advocate of telecommunications policies of the current Administration, which has as a priority the establishment of technical standards to make possible new broadband technologies, and to achieve universal broadband availability by the year 2007. It is also, fundamentally, obligated to administer and protect Federal allocations and assignments. So NTIA's obligation is to facilitate new broadband technologies and to protect sensitive Federal radio communications, necessitating a somewhat illusory balancing act in this proceeding. While NTIA should have tempered its laudatory comments by, and should have incorporated in them the reality of BPL's interference potential revealed by its own study, NTIA's comments are reflective of the Administration's broad overall policy, not of the interference potential of BPL.

10. Second, NTIA is concerned with interference to Federal systems, not to Amateur Radio stations. The latter, but not the former, are typically located in residential

areas. Federal systems are typically located away from populated areas, and thus not necessarily or in every case in close proximity to power lines. The interference potential of BPL systems is far greater in residential areas, where overhead power lines are prevalent and in close proximity to Amateur fixed station antennas. According to the NTIA's *Spectrum Allocation Final Report, Response to Title VI, Omnibus Budget Reconciliation Act of 1993*, NTIA Special Publication 95-32, February, 1995 at Appendix B, page B-2:

The amateur radio service has successfully co-existed with Federal fixed, mobile and radiolocation services (i.e. radar) for nearly fifty years. As indicated in many of the public comments on the Preliminary Report and the FCC NOI, this sharing arrangement has been successful for both Federal and amateur spectrum users. This success is primarily due to the fact that much of the Federal spectrum usage is located away from populated areas, minimizing potential interference...

11. Third, NTIA's comments, at 2, state that its approach to this proceeding was to (1) focus on what interference risks are posed by BPL, and if they are too high, to determine how can they be suitably reduced while fulfilling at least minimum BPL "requirements"; and (2) to determine, if interference from BPL is "suspected," what the difficulties are in diagnosing and eliminating it. ARRL does not fault this approach, though the success of that formula for analysis is largely dependent on the preconceptions that NTIA brings to the table. Any reasonable review of the NTIA study would have to conclude that the "interference potential [of access BPL]" is "too high." Indeed, that is the conclusion reached by NTIA Acting Assistant Secretary Michael D. Gallagher in a speech delivered May 17, 2004. He said that the Phase 1 NTIA Study showed that "interference risks are high under existing FCC Part 15 rules." The failure of the Commission and of most of the BPL proponents to acknowledge that fact, and evaluate

BPL with that premise is a serious obstacle to arriving at a reasonable technical solution to the interference problem and allowing some BPL configurations to operate. Similarly, the suggestion of NTIA that BPL interference may be “suspected” (rather than firmly established) because some radio systems may have degraded receiver performance due to rodents chewing transmission lines,¹³ or because received interference may come from another source, is not encouraging. Simple on-off testing of BPL systems is an easy determination of interference causation. The idea that diagnosis of BPL as an interference source is somehow difficult is sophistry. It creates a blueprint for scapegoating; something that some power utilities and BPL equipment or service providers have utilized in this proceeding, and which will certainly be used in the future as a means of avoiding their obligation to either avoid or resolve interference, or shut down their systems.

12. NTIA’s comments, at 3, suggest that the technical answers for BPL interference are “at hand” and are “reliable” and should be applied “as soon as possible.” ARRL disagrees. While as discussed below, ARRL agrees with many of the NTIA suggestions for reducing interference susceptibility, these solutions are untested, not shown to be reliable or sufficient whatsoever, and there is far too little experience with them to conclude that the substantial interference potential revealed by the NTIA Study can be managed, much less eliminated.

¹³ ARRL can only speak to the typical integrity of Amateur Station facilities and not that of other types of HF station. However, the idea that an Amateur station maintained at a licensee’s residence or in a licensee’s vehicle has degraded desired signal reception ability due to rodents chewing transmission lines or other causes is not well-taken. Amateurs are skilled in station maintenance and configuration, and with very few exceptions, take pride, often competitively, in the maintenance of their stations to insure optimum receiver sensitivity and selectivity. BPL interference is not likely to be mistaken, save for possible occasional confusion with other, often-encountered power line noise, which is epidemic in residential areas.

13. ARRL agrees that specific definitions of Access BPL should include, as NTIA suggests, “all electric power lines owned, operated or controlled by an electric service provider.” That provides the proper focus for interference resolution.

14. NTIA argues at page 4 of its comments that BPL is a “win-win” situation, and begins with the proposition that the “potential public benefits of BPL technology and BPL capabilities for eliminating interference argue strongly for “accepting a degree of interference risk.” Not so. Licensed radio services operating in the sensitive HF environment should not have foisted upon them a substantial interference risk from unlicensed devices or systems whatsoever. That is precisely contrary to the Communications Act, which requires that any RF devices which have an interference potential to licensed radio services be licensed themselves. 47 U.S.C. § 301. It is also contrary to the specific obligations of the United States under the Radio Regulations cited hereinabove. NTIA’s assertion is that, somehow, by allowing BPL systems on Low Voltage (LV) and Medium Voltage (MV) lines, the current (admitted) lack of RF integrity of those lines, which has led to hundreds of instances of interference to Amateur Radio stations, will be improved. The premise is that BPL signals necessitate quiet power lines and that therefore, the addition of BPL will somehow cause the fixing of routine power line noise. This is a *non-sequitur*. Replacing one interference source with another in the same bands is not in any way beneficial. Furthermore, ARRL has never argued that power line noise and BPL signal interference are additive; one is independent of the other.¹⁴ The references to the large numbers of unresolved power line interference cases

¹⁴ In measurement studies conducted by Metavox for ARRL in North Carolina, just completed, Metavox encountered a situation where power line noise was so high on certain frequencies that the BPL signal could not be measured. It was necessary to find frequencies devoid of power line noise in order to measure a BPL signal.

establish, rather, that power utilities have an exceptionally poor track record of interference resolution in general. There is no reason to believe that, whether power line noise is supplanted by BPL interference or not, there will be any steps taken by utilities or by BPL service providers to eliminate BPL interference. The recent experience with BPL test sites proves this point beyond any reasonable doubt. If the Commission had timely adjudicated the *bona fide* complaint of Mr. James Spencer, W0SR in Cedar Rapids, Iowa, for example, it would find that high power line noise is not an impediment to BPL signals. Mr. Spencer's Amateur Station has been for years subject to power line noise, and is today. That noise still exists at levels which preclude Amateur Radio HF communications. The BPL interference is a separate interference source which has exacerbated an already severe interference problem that the utility and the BPL provider are unable or unwilling to remedy.¹⁵ The suggestion, therefore, that BPL is a "win-win" is incorrect. It is unproven technology in terms of marketability, and it is indisputably an additional source of substantial interference, beyond that already suffered by licensed Amateur Radio stations from power line noise. NTIA admits that it has measured power line noise that is higher than the limits proposed for BPL radiated emissions (and therefore higher than Part 15 rules allow now, thus proving the inability of utilities to comply with Part 15 rules). There is no evidence that BPL systems can or will operate only in the absence of high power line noise. Amateur experience, especially in the

¹⁵ Power utility companies often receive complaints of harmful interference to licensed radiocommunication services resulting from sparking and corona discharge. The radio users receiving such interference are entitled to prompt resolution of the interference. However, no one would expect the interruption of electrical service to scores of customers until the problem can be rectified. The situation with regard to BPL interference is entirely different. The radio users receiving interference from a BPL source have every right to expect that the interference will be eliminated immediately upon notification to the operator. The failure of Alliant Energy, Progress Energy and other BPL test site operators to resolve interference, and their refusal to cease operation of the interfering system in view of their inability to resolve the interference, and where the interference has been allowed to persist for 11 weeks or more, is simply indefensible.

vicinity of Cedar Rapids, Iowa, establishes a different conclusion: that BPL systems are indeed operating regularly in areas of high, interference causing, power line noise, and by superseding the interference already received by the nearby Amateur stations, adds to the interference problem suffered by the Amateur Radio stations.

15. NTIA argues at page 7 of its comments that it supports the Commission's proposed (and the Part 15 existing) radiated emissions limits for carrier current systems as the limit for BPL systems. This is highly anomalous, since its own study concluded that the interference contours at those same limits for both fixed and mobile facilities are exceptionally large, as discussed hereinabove. NTIA offers no technical justification for this conclusion, nor does it attempt to harmonize its findings in the Study with the suggestion. However, NTIA does suggest the creation of coordination and exclusion zones, and suggests that there should be some excluded bands. Indeed, one of the significant recommendations in the NTIA BPL report is to avoid "locally used frequencies." NTIA offers only anecdotal examples of exclusion zones and excluded bands, such as the National Radio Quiet Zone; the band 74.8-75.2 MHz used for aircraft reception of marker beacons used in conjunction with Instrument Landing Systems, and those around Coast Guard stations in the 2.1 MHz band used for distress alerting. This is an obvious acknowledgement that BPL should not be allowed to operate in close proximity to HF and low-band VHF facilities. NTIA claims that BPL proponents have already demonstrated capabilities for implementing such restrictions, for example by "notching out frequencies allocated to the amateur radio service." *NTIA Comments, at 8.* ARRL would strongly urge, if the Commission has any intention of implementing BPL in the HF bands, or in the 30-80 MHz band, that Access BPL be precluded from utilizing

any Amateur HF or VHF allocation, in addition to any other bands that NTIA determines require protection from BPL interference. Any other action is an invitation to epidemic, widespread interference problems.

16. In contrast to the solid science of its Phase 1 BPL study, NTIA's comments in this proceeding reveal its zeal to demonstrate the technology's viability. To reduce the interference risks from BPL, which NTIA acknowledges only implicitly, its comments recommend "several new BPL rule elements" to augment the FCC's proposals. It claims that "[t]hese rules also help ensure that interference from BPL systems would be eliminated expeditiously with little effort needed on the part of any radio operator." NTIA claims that its recommendations shift emphasis away from eliminating interference and toward preventing it. Conceptually, that is a step in the right direction. ARRL disagrees with NTIA's premise, however, that BPL operators have an incentive to prevent interference. "NTIA believes that BPL operators, as the parties responsible for eliminating harmful interference, will voluntarily implement equipment, organizational elements, and installation and operating practices that prevent interference and facilitate interference mitigation." ARRL's experience with test sites has been precisely the opposite: Denial is the prevalent *modus operandi* of BPL providers at test sites and of the two BPL associations. NTIA states that "[m]arket appeal of BPL could quickly evaporate if BPL systems were to endemically cause interference and have to be shut down with operating authorizations swiftly revoked if necessary." *NTIA Comments at 8*. However, as ARRL has noted in its comments, the history of voluntary utility compliance with FCC interference avoidance or resolution obligations, and the history of Commission enforcement in this area, is abysmal. There is no reason to believe that utilities and BPL

providers will do anything with BPL interference complaints except deny or ignore them. To date, the Commission has allowed the BPL test sponsors that unearned luxury and has itself followed suit. If interference is so easily resolved by the BPL system operator, why have the interference problems at the test sites not been resolved?

17. ARRL supports NTIA's proposed coordination procedure, whereby BPL operators will have to conduct prior coordination of potentially affected receiving stations at known locations or service areas with potentially affected licensees.¹⁶ It is unclear why NTIA believes that this will somehow prevent interference to radio receivers at known locations, however, unless it is coupled with the obligation on the part of the BPL operator to configure the BPL system to not use frequencies that the licensed station uses in that same area. NTIA recommends that the Commission make proposed BPL deployment notification requirements retroactive. BPL operators "should be required to notify of planned deployments at least 30 days in advance of implementation and to consider the coordination data they receive regarding local radio receiver operations in order to prevent interference." *NTIA Comments, at 10-11.*¹⁷ According to NTIA, such advance notification would give "local radio receiver operators" a chance to inform BPL operators of potential interference situations. To make it possible for radio operators to diagnose suspected BPL interference, BPL operators should provide to those radio operators sufficient details of the BPL emission to enable identification. NTIA

¹⁶ This procedure, while helpful, would be difficult to implement for Amateur Radio station notifications. Amateur Radio licensees are not required to list their station locations on their licenses. Rather, the licenses only reflect mailing addresses of the licensee. The stations may be located elsewhere. So, notifications of BPL startup operation might not be sent to a licensee whose station is located at a second home, for example, or in an area where a mobile or portable station is established.

¹⁷ It is unclear what the obligation to "consider" the coordination data entails. Presumably, the BPL operator would have to demonstrate what it did in response to the coordination data to prevent interference, but that requires both good faith and the real threat of enforcement, and there is now little evidence of either.

recommends precluding BPL operation on locally used frequencies (presumably including Amateur Radio frequencies) when there is insufficient distance separation for interference-free, co-frequency operation with respect to radio receivers at known nearby locations. There would presumably be an additional safety factor added to the interference contours measured by NTIA, to address the additional interference area resulting from high-gain antennas used in the Amateur Service and the extremely weak desired signal levels typically utilized by radio amateurs. ARRL would support this coordination procedure (though it is not a comprehensive interference avoidance mechanism, as discussed above). However, as noted above, a simpler and far more effective mechanism with respect to the Amateur Service for all concerned would be to avoid use of any Amateur Radio allocation nationwide.

18. It is unclear whether NTIA's proposal for advance notifications by BPL providers to local radio licensees would include Amateur Radio operators, but it would seem to apply across the board, and as such, ARRL supports the proposal. It, unlike the Commission's vague "interference mitigation" proposal, would appropriately place the burden of interference avoidance (by initial configuration of the BPL system) on the utility or BPL provider, rather than putting the burden of initiating interference resolution provisions on the licensee victim *post hoc*. However, again, this plan requires good faith on the part of the BPL provider, and a baseline of enforcement on the Commission's part.

19. NTIA recommends that BPL providers be required to include in their notifications to licensed radio operators the BPL system configuration, including modulation details, the maximum number of access BPL devices in a given deployment and the method of power control. This would allow identification of BPL waveforms.

Transmission of identification codes would also facilitate interference diagnosis. This is obviously in the public interest and should be required of BPL operators, as is the suggestion that BPL operators provide a single point of contact by telephone for each deployment area for interference resolution, at a control point where immediate diagnosis and interference resolution (as NTIA put it, in a “matter of seconds”) can be effectuated. *NTIA Comments, at 13.* ARRL would support these interference avoidance measures, but would prefer that no amateur radio allocations be utilized at all. It is noteworthy that this single point of contact will not be of any value in cases of BPL interference to mobile stations.

20. NTIA, acknowledging ominously that “Access BPL devices pose interference risks that are among the highest of the various kinds of authorized, unlicensed devices” also recommends that the Commission require certification by BPL operators of the embedded systems, rather than verification of BPL devices by manufacturers of the devices, relative to equipment authorization procedures for BPL systems. “Because Access BPL systems pose relatively high interference risks, certification rather than verification should be required.” Certification would require submission of test data of *in situ* installations to the Commission, as opposed to having a BPL operator or device manufacturer merely attest that its system or device complies with FCC rules. This is a critical component of accountability on the part of the operator of the system, and must be required if any BPL systems are to be authorized at all. NTIA is correct that the bifurcation of compliance testing and interference resolution obligations in the case of BPL would be unreasonable, in view of the fact that BPL operators would be operating a system for profit, rather than consumers operating individual devices. NTIA

appropriately views BPL systems as analogous to cable television systems, which are closed and intended not to radiate RF energy, but which in fact do radiate RF energy on frequencies allocated to licensed radio services, including public safety and safety-of-life services. The systems are somewhat analogous (though of course power lines are not a closed system at all) and the same obligation of interference avoidance and system monitoring obligations must be placed on BPL operators.¹⁸ Furthermore, as with cable television, certain bands should be unavailable to BPL systems, including Amateur bands, due to inevitable geographic proximity and what NTIA describes as a high interference potential.

21. As to measurement techniques, NTIA notes correctly that, absent some changes in the proposed measurement procedures, the existing field strength limits provide “inadequate” assurances that interference risks will be confined to the levels allowed. *NTIA Comments, at 15*. ARRL agrees with essentially all of the proposed changes recommended by NTIA. The differences in measurement distances for Part 15 devices operating above or below 30 MHz, and the 30-meter measurement distance in particular (used for devices operating below 30 MHz) provide problems. NTIA recommends a uniform measurement distance of 10 meters. More importantly, the current part 15 extrapolation factor for field strength with increasing distance is not suited to BPL installations due to the line source radiator character of BPL systems. Most important is NTIA’s conclusion that the normal means of measuring Part 15 device

¹⁸ It is important to note, however, that a cable system operates well below the maximum emissions limit in most areas of a cable plant. Leaks that do occur are caused by a correctable defect in the cable system. Where a leak causes interference, the shielded nature of the cable system is such that the shielding can be locally improved, or minor defects identified and corrected. By contrast, a BPL system operates on an unshielded line, at or near the FCC emissions limits in its entire geographical region. Given these differences, there is no justification for requiring monitoring of cable systems in minute detail, while merely allowing BPL systems to be “verified”, a far less secure means of regulating interference potential to over the air radio services.

emissions on certain radials from the device does not work well for BPL because “in most cases, peak field strength levels are not centered on the BPL device and multiple segments of the power lines and impedance discontinuities are the most significant BPL signal radiating elements.” *NTIA Comments, at 18*. Therefore, measurements of the devices alone are insufficient. The peak BPL field strength is “not necessarily located at the BPL device.” NEC modeling using a (vertical) antenna perpendicular to the (horizontal) power lines shows multiple peaks of BPL electric field strength occurring at locations tens of feet from the power lines and BPL devices. Relatively high emissions can occur at various distances from the BPL device along the power line. It can occur at a fraction or multiple of a wavelength from the BPL emitter. So, NTIA suggests requiring constant monitoring for peak emissions along the line, wherever those peaks occur. ARRL agrees with this assessment, and suggests that it validates ARRL’s contention (which, without offering any technical justification for their disagreement, the BPL advocates deny) that BPL signals are line-source radiators and not point-source radiators. In any event, the objective of the measurements is to find the peaks, as distinguished from measurements at specific fractional wavelengths. Once the peaks are found, the signal should be expected to oscillate predictably at those intervals.

22. Finally as to measurements, NTIA suggests that the standard measurement height should be one meter, even though the majority of receiver antennas used by government stations are located two meters or higher above the ground. For purposes of convenience and repeatability of results, ARRL concurs with this recommendation. NTIA also recommends a 5 dB height correction factor used in connection with measurements using a one-meter height. In fact, NTIA observed larger differences in some cases, so a 5

dB correction factor is conservative. This is a far simpler mechanism than to attempt to find field strength peaks at various distances from the lines and at various heights as well. The 5 dB correction factor makes sense, inasmuch as NTIA has determined that 80 percent of the local field strength peaks at any height will be within 5 dB of the peak electric field strength measured along the power line at a height of one meter.

23. NTIA's comments endorse a series of technical requirements which reflect the need to carefully measure BPL emissions due to their substantial interference potential to licensed services. NTIA recommends that all operating frequencies should be considered and that maximum operating power should be measured at each frequency. Measurements below 30 MHz should be done with a calibrated loop antenna with an appropriate magnetic-to-electric field conversion factor, and an electric field antenna should be used above 30 MHz. Compliance measurements should be done on power lines that yield the highest levels of field strength, given the wide variation in parameters and radiation properties of power lines. Also, measurement bandwidth should be specified in the rules, and spectral power distributions of BPL emissions should be measured and included in the certification report. This will facilitate identification of the system for interference diagnosis purposes on the part of the BPL operator. ARRL views each of these as good suggestions. It does not, however, believe that any combination of NTIA's well-intentioned technical operating requirements will be sufficient to avoid widespread interference to Amateur Radio stations in residential areas, or in vehicles. ARRL believes that BPL has been demonstrated to be a most egregious example of a spectrum pollutant which threatens the most sensitive natural resource in the radio spectrum. NTIA's technical studies are sound, and their factual conclusions reasonable. Their technical

suggestions in the comments are well-intentioned and, in the main, useful should any form of BPL be permitted in the HF and low VHF spectrum. The recommendations are aimed at interference avoidance or suppression, rather than “mitigation,” and as such are far preferable to the Commission’s rather feeble and wholly inadequate proposal for interference “mitigation” *post-hoc*. However, no one interference avoidance mechanism will be adequate for an interference source of this magnitude. BPL systems would have to be prepared to shut down at unpredictable times, without notice, in order to comply with the Commission’s Part 15 rules. ARRL does not believe (especially given the poor performance experienced at BPL test sites) that BPL providers are prepared to do that voluntarily, and the Commission’s enforcement resources have been shown consistently to be grossly inadequate to deal with interference problems of this magnitude. While NTIA’s obligation to advocate the Administration’s policies and its competing obligation to protect Federal communications systems from interference adds a touch of schizophrenia to the NTIA comments, in the end, the NTIA study speaks for itself. BPL cannot be implemented without overwhelming and preclusive interference potential to licensed services, and especially the Amateur Radio Service.

IV. Comments of BPL Proponents

24. As noted above, the vast majority of the comments in this proceeding oppose BPL due to interference considerations. The Commission cannot, on this record, reasonably proceed to authorize BPL without substantial restrictions, including, but not limited to prohibiting any BPL operation on any frequency allocated to the Amateur Radio Service. In the main, BPL proponents’ responses to the Notice followed their prior tactic of refusing to debate the technical interference issues. A few, however, have made

egregious errors in technical analyses and assumptions concerning BPL, as discussed herein.

25. Most of the comments filed by BPL proponents addressed the potential of BPL to provide broadband service to rural and underserved areas. The Commission cited the potential in the Notice as a principal justification for this proceeding. *See, the Notice, at paragraph 12.* Ignored, however, in that analysis were the Joint Reply Comments of the National Rural Telecommunications Cooperative (NRTC) and the National Rural Electric Cooperative Association (NRECA), filed in response to the NOI in Docket 03-104, which stated in relevant part, at pages 5 and 6 thereof:

NRECA and NRTC have been closely monitoring the state of BPL technology, the status of BPL developers and vendors, and the viability of BPL for rural consumers. In 1997, NRECA's Cooperative Research Network (CRN) completed an investigation of the potential of power line carrier for high speed data communications. The research project determined that high speed data communications over power lines was not viable nor would it be for several years due to technical and economic barriers. In 2000, NRECA's CRN and NRTC co-sponsored an investigation to update the status of high speed data communications via power line carrier. The investigation did not reveal any developer or vendor at the time that appeared likely to surmount the interrelated technical and economic hurdles.

In 2001 and 2002, BPL development activity accelerated and new developers and vendors and other organizations appeared. Earlier this year (i.e. in 2003) NRECA's CRN and NRTC co-sponsored a research project to again investigate the prospects of BPL for rural consumers. The results were presented in a conference in Cincinnati on July 28 and 29, 2003, that was attended by approximately 150 electric cooperative representatives. All but one of the leading BPL vendors in the U.S. participated as presenters and exhibitors.

The 2003 CRN/NRTC investigation revealed several existing and new developers and vendors that are making progress with BPL technology for deployment in the United States. They are working to overcome the technology barriers...

However promising these developments may appear to be, the 2003 CRN/NRTC investigation also suggests that BPL will not be a viable solution for most Americans in truly rural areas any time soon. The very limited deployment of BPL technology within the U.S. involves traversing only a mile or two of power distribution lines in areas with relatively dense population. Many rural Americans are served by electric distribution lines that are many miles long with as few as one or two consumers per mile of line along many parts of the line. To date, no BPL system has been demonstrated to work, much less been commercially deployed, on a long, sparsely populated rural electric power line.

NRECA and NRTC are aware of the existence of numerous distribution feeder lines owned by rural electric cooperatives that are more than 20 miles in length, and some lines that traverse distances of well over 100 miles. Even if BPL technology proves to be reliable and does not cause unacceptable radio frequency interference in rural deployment the economics will likely be prohibitive for some time to come. This is because signal repeaters or regenerators will be required at intervals as small as one-fourth to three-fourths of a mile along lengthy rural power lines. In addition numerous new network access points (NAP) and backhaul lines to NAPs will be need to connect these rural lines to the internet backbone.

NRTC, NRECA and their members do not believe that there is sufficient data available to draw valid conclusions about the technical performance of BPL in urban or rural settings because of the extremely limited volume and concentration of deployment in the United States. It appears that there are far fewer than 1000 retail subscriber endpoints presently in service in the United States. None of them is deployed with a significant penetration of potential subscribers in a proximate geographical area. Only with actual data on performance and radio frequency interference for BPL in a full deployment environment will it be possible to predict with confidence that there will be no adverse interference with other wireless or wire-line applications or users. There have been reports of adverse experience with unintentional radiation effects in Europe and Japan leading to restriction over BPL deployment there.

ARRL has extensively quoted these comments filed in the NOI proceeding because they provide a complete rebuttal to those comments in response to the Notice which urge that the Commission continue its rush to judgment on the BPL issue now. There is no need to move quickly to authorize BPL in the United States because it is not presently a means of providing rural broadband service. There is, rather, a need to adequately investigate and

evaluate what NTIA repeatedly describes as the substantial interference potential of BPL.

26. The Commission should place this proceeding on hold for a year in order to reasonably evaluate the success or failure of interference prevention techniques. The reply comments of the California Public Utilities Commission and the People of the State of California in this proceeding, filed June 4, 2004, echo the same cautionary advice:

“The CPUC generally supports the Commission’s efforts to promote competition in the offering of broadband infrastructure. However, given that BPL is still very early in its development, it has not yet shown to be a viable and robust alternative to other broadband services such as DSL and cable modem. Hence, the FCC should not rush to further deregulate all broadband services at this time. Rather, the FCC should consider what changes, if any, are needed to the current regulatory scheme, *after extensive testing has been performed and industry standards have been developed for BPL systems.*” CPUC Comments, at 3 (emphasis added).¹⁹ Oncor Electric Delivery Company, in comments in this proceeding, stated similarly that it believed that BPL may well present a significant opportunity to broaden public access to broadband services, and that utility industry benefits may be available in the longer term, but that “Oncor does not believe that those utility industry benefits – as presently envisioned based on the state of BPL development – would justify investment in and deployment of BPL.” *Oncor comments, at 1.* Given the fact that Access BPL is not ready for widespread deployment, and the utilities that stand to benefit from it are reluctant to invest in it due to the early state of its development, the

¹⁹ ARRL notes that the Institute for Electrical and Electronics Engineers (IEEE) held a meeting June 7, 2004 in Denver at which the desirability of a BPL standards activity was discussed. This will be addressed again at a followup meeting on July 22, 2004. This activity is in its early stages and should be permitted to run its course. ARRL intends to be an active participant.

Commission's hurry to implement this dangerous interference source is completely unjustifiable.

27. Some comments provide technically inaccurate showings that lead to false conclusions. For example, Ameren Energy Communications, Inc. (AEC) which is engaged in BPL testing, continues to claim (even in the face of measurement data in the NTIA Study which proves exactly the contrary) that "the emissions from Access BPL systems will occur more from the individual devices and less from the power lines that carry the BPL signals." They claim that there is "no harmful antenna effect associated with the power lines." This is demonstrably false. Attached hereto as Exhibit A is ARRL's NEC study, prepared by ARRL Laboratory Supervisor Ed Hare. This study notes the multiple errors in the AEC conclusions, both with respect to the point source radiator claim of AEC and its attempted rebuttal of the use of magnetic loop antennas for measurement of BPL signals. Hare's study also addresses other measurement issues discussed to some extent above. Principally, the conclusion to be drawn from Exhibit A is that the NTIA Study correctly concluded that the peak signal strength from BPL systems does not typically occur near the BPL device, but down the power line, and that power lines radiate as line source radiators, not point source radiators. Current Technologies comments make the same error, suggesting that its implementation of BPL does not involve any radiation from power lines at all, except for a short stretch immediately adjacent to an operating BPL device. That is demonstrably false, and both ARRL engineering submissions and specific NTIA measurement findings directly rebut Current Technologies' unsupported assertion. Others that have studied the issue are in agreement

with ARRL and NTIA. Aeronautical Radio, Inc. (ARINC) comments, at 7, stated as follows:

While any measurement program must take into account signals from [injection sites and devices used to pass BPL signals around transformers], the ability of power lines carrying RF to act as antennas and radiate the RF must also be addressed. The Commission has attempted to do so by recognizing that additional measurements along a power line may be required in certain circumstances. In analyzing the characteristics of power lines carrying HF RF signals, ARINC engineers have conducted simulations using Numerical Electronics Code NEC-4 Method of Moments software. These simulations revealed that power lines exhibit lobes at various frequencies in the HF band and that, depending on frequency, line spacing, injection mode and impedance characteristics, these lobes can have positive gain with respect to an isotropic radiator. These lobes are located away from Access BPL devices. As such, power lines definitely exhibit characteristics that are much like those of other antennas, albeit with great variation due to the large number of possible configurations within any Access BPL system...

28. AEC's comments provide a good example why the Commission cannot rely on existing Part 15 rules to address fundamental incompatibilities between BPL systems and Amateur Radio Stations. AEC is apparently unwilling to avoid use in BPL configurations of locally occupied frequency bands. It objects to the Commission's proposed Section 15.109(f), the purpose of which is to "avoid site-specific, localized use of the same spectrum by licensed services." AEC seeks to modify that requirement to simply prohibit causing harmful interference to licensed services. That, however, is already proscribed by Section 15.5 of the Commission's Rules, and as well by provisions of the international Radio Regulations. AEC also objects to incorporation of a shut-down feature that would deactivate BPL units found to cause harmful interference. This is evidence that BPL providers have no intention of complying with Section 15.5 of the Commission's rules, which already requires that Part 15 devices and systems shut down

where interference is caused. AEC states that going beyond power reductions or changes of frequency, and shutting down service to a BPL subscriber without warning is “unwarranted” in view of the field experience of experimental systems. In fact, immediate shutdown of BPL systems is precisely what is “warranted” and what is required under existing rules.²⁰ BPL systems in various locations, including Raleigh, North Carolina and in Cedar Rapids, Iowa, after receipt of complaints of interference, have failed to remedy the interference, and have then refused to take other remedial steps after the BPL provider’s initial interference resolution efforts have failed. In the cited cases, and in dozens of others, none of the BPL providers has agreed to shut the interfering BPL systems down. The most glaring effort to shirk the current obligations of a Part 15 device or system operator is revealed at page 10 of AEC’s comments. AEC objects to any requirement that BPL providers file information about proposed installations and changes to existing systems because that “implies some form of right to protest such changes and installations, or sanctions for failing to provide that information.” It should not be news to AEC that the Commission’s rules now confer standing on a Commission licensee to object to any Part 15 device or system configuration which results in interference to the licensee’s services. AEC should make no mistake: ARRL fully intends to pursue instances of BPL installation which result in interference to licensed Amateur Radio stations.

²⁰ This is the typical response of a proponent of a Part 15 technology. They want all the benefits of unlicensed operation, including cost savings and absence of regulatory delays in startup of operation, but none of the attendant obligations. A potential investor in BPL technology should beware: instances of interference from BPL test sites, or any BPL installation that causes interference to licensed Amateur Radio stations by rule will result in initiation of enforcement action that should necessitate shutdown of BPL operations.

29. Some BPL proponents have erred in the means by which they attempt to determine whether BPL systems are or are not compliant with the present Part 15 rules. For example, in comments filed in response to the Notice, Progress Energy provided information on the test methods that Amperion, the manufacturer of the BPL equipment used in Progress Energy's system, used to verify the installation as being compliant with the FCC regulations for radiated emissions for carrier-current systems. As shown in Exhibit B attached, there are numerous errors made in the test procedure Amperion used to verify this system for compliance with Part 15 emissions limits. They include:

- The use of a spectrum analyzer that does not use a quasi-peak detector
- Use of a detector mode that undersamples the measured signal levels
- Use of a test antenna that has insufficient sensitivity over part of the measurement range
- Measurements made directly under the power lines
- Measurements made at a slant-range distance of less than 30 meters that are extrapolated to 30 meters using an extrapolation that does not work accurately for line radiators

Given these errors, ARRL does not believe that any Progress Energy BPL system has been verified as required by Part 15 regulations. The total error that results from the ways that this system was improperly tested is potentially as high as 25 dB. Given this example, it is unclear that BPL providers will have the ability or incentive to maintain their systems in compliance with whatever maximum radiated emissions are permitted by the Commission.

30. Repeatedly encountered in the comments of BPL proponents is the denial of interference reported in connection with BPL test sites. The web site of the Power Line Communications Association has posted a claim that there has never been a *bona fide* interference complaint from BPL test sites. This is an allegation that PLCA knows is

false and has admitted to ARRL is false. It nevertheless remains on the PLCA web site. Comments filed in this proceeding by the American Public Power Association falsely stated at page 5 that during a trial period, the City of Manassas, Virginia “did not receive a single report of harmful interference. As Manassas has started to commercially deploy this service throughout the city, it still has not received any complaints of harmful interference.” As discussed above, there are dozens of harmful interference complaints about BPL test sites pending and unadjudicated at the Commission, including the Manassas system. The BPL providers at many test sites are well aware of these complaints, because the interference is brought to their attention first, and interference resolution is requested. The continued denial that there is any interference demonstrated, or allegations that the interference at BPL test sites is not “harmful” interference, is a gross exhibition of bad faith on the part of BPL providers. As ARRL noted in its comments, the denial of interference, in the face of mounting *a priori* evidence to the contrary, is necessitated from the perspective of BPL advocates by marketing considerations. No municipality, power utility, or other potential investor would consider an investment in BPL technology if the truth was known about the interference potential of BPL.

31. With respect to the Manassas BPL system, which is touted as a success story by BPL proponents, all is not as represented. First of all, the inference from the comments of the City of Manassas, including a letter to the Experimental Licensing Branch, Office of Engineering and Technology, is that the interference complaints by members of the Ole Virginia Hams Amateur Radio Club (OVH), based in Manassas, have been addressed. They have not. There is interference on various HF frequency

bands from the rather minimal Manassas system, about which the OVH has complained to the Commission, without response. ARRL's engineering consultants have measured RF from the Manassas site, as reported in ARRL's comments, and found that the radiated emissions exceed the Part 15 limits across the range 3.5-14 MHz, the highest point being at 8.75 MHz, which is approximately 5 dB above the Part 15 limits. This BPL radiation would cause serious interference to a fixed station having its antenna 30 meters from the BPL line. Manassas' comments claim that the BPL system there "is currently available to about 3,000 homes." This is at best, misleading, if not outright misrepresentation. The Manassas system actually serves, on information and belief, less than 200 homes. However, the franchise in Manassas, held by Prospect Street Broadband has been terminated, and no replacement service has been found to date. The project to date is a failure and certainly is not the model that the Commission should tout as an example of BPL feasibility.

V. Comments of BPL Opponents

32. The Commission cannot gloss over the interference concerns of others besides radio amateurs. The Boeing Company's comments, filed May 3, 2004, raise the serious specter of interference to essential, safety-of-life communications services in the aviation industry from BPL. The HF frequencies are critical for long-haul communications with aircraft in flight. Because these communications are conducted over paths of many thousands of miles using signals only marginally above the noise floor, and the ground stations use, of necessity, omnidirectional antennas and sensitive receivers,²¹ BPL signals have an interference potential that is unacceptably high. The Commission's

²¹ The receiver sensitivity of a typical HF receiver used in aviation communications is -113 dBm. When HF aeronautical communications receivers are setting up for system checks, signal levels as low as -120 dBm are typically checked. *Boeing comments, at 5.*

Notice in this proceeding offers absolutely no interference mitigation opportunities for aeronautical HF networks. To permit BPL on the current record is to risk the lives of passengers and crew aboard aircraft. As Boeing states:

The [Notice] attempts to justify [the claim that properly designed and operated BPL systems will pose little interference hazard to, *inter alia*, non-amateur services such as aeronautical radio] by arguing that “most public safety systems are designed so that mobile and portable units receive a signal level significantly above the noise floor (citation to Notice omitted). The [Notice] also indicated that “although some public safety systems operate between 25-50 MHz, most public safety networks operate above 50 MHz. (citation to Notice omitted).

The [Notice] fails to acknowledge, however, that aeronautical HF radios generally operate only slightly above the noise floor using spectrum allocated below 30 MHz to receive critical communications often from thousands of miles away. In this regard, aeronautical HF communications networks operate in a manner far more similar to amateur radio devices than local or regional public safety networks.

...[T]he [Notice] did not take into consideration the significant risk that exists of harmful interference into aeronautical radio systems and the serious potential consequences in terms of the loss or disruption of critical, safety-of-life aeronautical communications. Furthermore, the interference mitigation techniques proposed in the NPRM are inadequate to protect safety-of-life aeronautical HF communications services. The Commission should carefully investigate these issues before adopting any rules authorizing the operation of Access BPL networks in spectrum allocated to aeronautical HF communications services.

Boeing Comments, at 7-8.

There is no better justification needed to await the Phase 2 NTIA report than the foregoing. The Commission simply cannot jeopardize the lives of passengers and crew of aircraft solely to rush to judgment on an untested competitive broadband alternative which uniquely has an established interference potential. ARRL argued in its comments that the potential benefits of BPL cannot be “balanced” against the interference potential to licensed radio services. The Boeing comments place the Commission in the position of

balancing the same dubious BPL potential benefits against potential loss of life and property. Even if a balancing test was proper in this instance, the scales tip away from BPL and in favor of safety of life communications every time.

33. The Commission's cavalier assumptions at paragraph 37 of the Notice about the light use of the low band VHF frequencies for public safety communications and their supposed immunity to BPL interference are baseless. As but one example, the comments of the Missouri State Highway Patrol reflect reasonable concerns about widespread preclusion of public safety communications. Missouri utilizes a statewide low-band VHF radio system with mobile coverage coordinated on a nationwide basis, with more than 1400 users in the State. As Missouri puts it: While the Patrol appreciates the merit of new technologies that can potentially provide broadband data to underserved rural areas, any new technologies introduced in those areas with potential to deteriorate a first responder's communications abilities has to be introduced cautiously, as the safety of the public and the preservation of a first responder's communications resources is paramount. While the Commission stated its "belief" that the risk of harmful interference to public safety systems is low, Missouri notes that "to date, comprehensive test programs that validate the Commission's beliefs have not been undertaken by the Commission. On the contrary, preliminary data gathered in the United States and abroad points to the potential of significant interference in spectrum between 2 and 80 MHz shared with BPL technologies." *Missouri State Highway Patrol Comments, at 2-3*. As to the interference mitigation techniques (which assist mobile radio services not at all) Missouri notes that these are "reactive, not proactive, and an incident of interference might risk the ability of a public safety end user to communicate at a time of crisis, creating an environment

where injury or death might be the result of a reduction in communications ability.”²²

For the Commission to risk these events and to jeopardize first responders and the citizens they serve by authorizing BPL without a full and comprehensive investigation of the interference potential to first responders is simply irresponsible. The State of Missouri reasonably demands a yearlong study to demonstrate the interference potential to public safety low-band VHF systems. ARRL can find no reason why the Commission would not want to require BPL proponents to demonstrate that they will not endanger first responders, persons and property. Missouri’s request is fair and reasonable.

VIII. Additional On-Site Measurements

35. Attached as Exhibits C, D and E hereto are additional on-site test results conducted by Metavox, Inc. under contract to ARRL. Metavox conducted electromagnetic emission tests at the Charlotte, NC, Raleigh, NC and Potomac, MD BPL test sites during late May and early June, 2004. The results are as stated in the conclusions portion of each report. Briefly, at Charlotte, in the presence of strong radiated emissions from the power lines due to 60 Hz electric current, the BPL signals were found to exceed FCC Part 15 limits by as much as 3.9 dB at the 30-meter distance using 2-axis measurements, and as much as 9.4 dB using single-axis measurements. The Charlotte tests reveal that the BPL systems do not require low levels of 60 Hz noise, contrary to NTIA’s assertion.

²² Perhaps the best example of this concern is with Native American tribal police communications, which are conducted on low-band VHF channels over vast stretches of rural, mountainous terrain, and with insufficient repeater infrastructure. To further reduce the capabilities of these systems by BPL interference along roadsides is to jeopardize both the tribal police officers and the people they protect and serve.

36. With respect to the Raleigh, NC BPL test site, Progress Energy has attempted to resolve instances of interference from the site to Amateur radio stations. Despite the expenditure of significant effort to adjust or modify this system to limit interference, substantial, harmful interference remains in the Amateur 14 MHz (20 meter) band. The measured radiated emission levels exceeded permitted maxima by up to 4.9 dB.

37. At the Potomac, Maryland test site, the Homeplug standard is used. This excludes Amateur radio allocations and interference was found to be lower there than in other bands. Nevertheless, BPL interference would be troublesome for receivers used in other radio services, such as the international broadcast bands.

IX. Conclusions

38. The NTIA Report speaks for itself. It clearly shows that BPL has associated with it an unacceptably high interference potential. Fixed Amateur Radio stations would, if BPL is deployed, suffer interference at distances of at least $\frac{1}{4}$ mile from a BPL line; if directional Amateur antennas are used, the interference contour in the main lobe azimuth of the receive antenna could be far worse. In Raleigh, North Carolina, interference to fixed Amateur stations has been encountered at almost two miles from the BPL system. Mobile Amateur Radio stations are subject to interference up to 75 meters from a BPL carrying power line. The experience of Amateur Radio operators is consistent with NTIA's study findings. There are many complaints of interference to Amateur stations from BPL test sites. The Commission has, to date, adjudicated none of them, and has in some cases, despite repeated requests, even failed to acknowledge the filing of them. The Commission has acted in this proceeding as though it wants no bad news about BPL, only

that which agrees with the unsupported conclusions contained in the Notice. ARRL is of the view that this proceeding has been prejudged, and will in the end be decided not on the technical issues that should control the outcome of this proceeding, but on the politics of the matter. Given the evidence on the Commission's table, it cannot now authorize BPL at the radiated emission levels proposed, and without substantial restrictions. These must include the suggestions set forth in the NTIA comments in this proceeding, and it must also include precluding the use of any Amateur Radio allocation whatsoever. ARRL would again urge that the Commission not permit Access BPL at this time. It should instead take a fresh look at BPL and place the matter on hold for a year. It should in the meantime require BPL providers to conduct interference tests with all stakeholders, and it should monitor the conduct and the outcome of those tests. If thereafter the Commission should decide to proceed with BPL rules, those rules should either preclude any use of Amateur Radio allocations, or guarantee that an interference causing BPL system can be shut down immediately in the face of a complaint, not after a BPL provider has taken months to discover that the interference cannot be resolved, all at the expense of preclusion of Amateur Radio HF communications. The level of accountability demonstrated to date by operators of BPL test sites is dismal and unacceptable. On the current record, it is obvious that the proposed radiated emission levels for Access BPL are too high, and the Commission has not proposed any rules which would predictably and reliably protect HF and low band VHF radio stations from interference. The interference resolution mechanisms that are adopted should be real, rather than merely illusory.

Therefore, the foregoing considered, ARRL, the National Association for Amateur Radio, again respectfully requests that the Commission address Access Broadband Over Power Line systems, if at all, in accordance with the foregoing comments, and not otherwise.

Respectfully submitted,

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