

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

PETITION FOR RECONSIDERATION OF SECOND REPORT AND ORDER

ARRL, THE NATIONAL ASSOCIATION FOR AMATEUR RADIO
225 Main Street
Newington, CT 06111-1494

Christopher D. Imlay
General Counsel
BOOTH, FRERET, IMLAY & TEPPER, P.C.
14356 Cape May Road
Silver Spring, MD 20904-6011
(301) 384-5525

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TABLE OF CONTENTS

Summary	
Petition for Reconsideration	1
I. Introduction.	2
II. The Interference Potential of Access BPL is Substantial; the Current Rules are Ineffective in Preventing Interference <i>Ex Ante</i> ; and Enforcement Remedies are Unavailable and Inadequate as a Substitute for Reasonable Preventative Rules for BPL Interference.	6
III. Information on Which the Commission Admittedly Relied in Adopting its Insufficient and Ineffective BPL Rules Shows that Access BPL has a Very Substantial Interference Potential, Requiring Full-Time Notching of Amateur Bands.	13
IV. Any Variability in the Median Noise Level, and Any Variability of the Decay of RF Fields Near Power Lines Militates in Favor of Requiring Full Time Notching of Amateur Bands By BPL Facilities, and Vitiates the Commission's Measurement Procedures.	22
V. The Distance Extrapolation Factor.	23
VI. Conclusions.	25
Exhibit A	
Exhibit B	

SUMMARY

ARRL, the National Association for Amateur Radio, also known as the American Radio Relay League, Incorporated (ARRL), requests that the Commission reconsider and modify the *Second Report and Order* (the R&O), FCC 11-160, released October 24, 2011, 76 Fed. Reg. 71892 *et seq.* The R&O made minimal changes to Part 15 of the Commission's rules governing unlicensed Broadband over Power Line (BPL) technology but otherwise reaffirmed those rules following remand of the matter from the United States Court of Appeals for the District of Columbia Circuit. The Commission continues to assert incorrectly that Access BPL operating in accordance with its reaffirmed rules has only a "small" risk of harmful interference that can be managed and corrected as needed on a case-by-case basis. This holding is inconsistent with extensive technical submissions in a fully developed technical record.

While BPL has failed in the marketplace as a medium for delivering broadband connectivity to consumers, the technology is still touted as a mechanism for "smart grid" applications. The Commission should acknowledge: (1) the unique and substantial interference potential of Access BPL systems relative to Amateur Radio HF communications; (2) the inapplicability and/or inadequacy of the current BPL rules to Access BPL/Amateur Radio interaction; (3) the clear necessity of mandatory, full time notching by Access BPL companies of Amateur Radio allocations to notch depths of *at least* 25 dB; and (4) the absence of any negative effect on BPL systems of the obligation to maintain full-time notching of Amateur bands. Mandatory full-time Amateur band notching to 25 dB should be implemented in the Part 15 rules.

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“The public must be able to trust the science and scientific process informing public policy decisions. Political officials should not suppress or alter scientific or technological findings and conclusions. If scientific and technological information is developed and used by the Federal Government, it should ordinarily be made available to the public. To the extent permitted by law, there should be transparency in the preparation, identification and use of scientific and technological information in policymaking.” President Obama, March 9, 2009; Memorandum for the Heads of Executive Departments and Agencies.

ARRL, the National Association for Amateur Radio, also known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to Section 1.429 of the Commission’s rules (47 C.F.R. §1.429), hereby requests that the Commission reconsider and modify the *Second Report and Order* (the R&O), FCC 11-160, released October 24, 2011, 76 Fed. Reg.71892 *et seq.* The R&O, pursuant to comments filed in response to the *Further Notice of Proposed Rule Making*¹ in this proceeding, made minimal changes to Part 15 of the Commission’s rules governing unlicensed Broadband over Power Line (BPL) technology but otherwise reaffirmed those rules following remand of the matter from the United States Court of Appeals for the District

¹ *Request for Further Comment and Further Notice of Proposed Rulemaking (Amendment of Part 15 Regarding New Requirements and Measurement Guidelines for Access Broadband Over Power Line Systems; Carrier Current Systems, including Broadband over Power Line Systems)*, 24 FCC Rcd 9669 (2009) (*Further Notice*).

of Columbia Circuit.² In reaffirming yet again its flawed rules governing Access BPL and by continuing to assert that Access BPL operating in accordance with those reaffirmed rules has only a “small” risk of harmful interference that can be managed and corrected as needed on a case-by-case basis³ the Commission has strained to discount extensive technical submissions that contradict its predetermined view. The R&O exhibits a highly disturbing, yet consistent and repeated pattern of obfuscation and denial that is directly counter to the current Administration’s promises to the public in 2009, cited above. The R&O is wrong in virtually all of its main premises and conclusions, and the 700,000 public service-minded licensees of the Commission in the Amateur Radio Service deserve more honesty and candor from this Agency. Now, on reconsideration, the Commission has one more chance to (1) address and manage, *ex ante*, the significant interference potential that Access BPL has in the High Frequency (HF) bands; and (2) to at least minimally protect the Amateur Radio Service in advance from the severe interference which will occur, and which has occurred in residential areas, absent adoption of modified rules for BPL. If the Commission does nothing else in this proceeding on reconsideration, it must modify the rules to require *full-time notching* of Amateur Radio allocations by Access BPL systems operating in the bands 3 to 30 MHz to a notch depth of at least the 25 dB that the R&O ordered that such systems be universally *capable* of implementing, because otherwise, Amateur Radio stations will have no remedy for the interference that will occur. As good cause for its Petition, ARRL states as follows:

I. Introduction

1. In this latest R&O, the Commission: (1) increased the notch depth that BPL modems must be capable of implementing in Amateur Radio allocations below 30 MHz from 20 dB to 25 dB, within eighteen months from the effective date of the R&O; (2) refused to require that this notching

² *American Radio Relay League, Inc. v. FCC*, 524 F.3d 227 (D.C. Cir. 2008).

³ R&O, at ¶ 14.

be implemented on a full-time basis in Amateur Radio Service allocations; (3) retained the 40 dB per decade of distance extrapolation factor for measuring BPL radiated emission signal decay; (4) specified a site-specific test method for making such measurements; and (5) reaffirmed its conclusion that the rules adopted in the first Report and Order⁴ in this proceeding are adequate to protect licensed Amateur Radio stations from interference from unlicensed BPL radiated emissions.⁵ By these holdings, the Commission has, once again, failed in its fundamental obligation to enact, and responsibly administer regulations that protect an important, international public resource; all in an effort to promote a failed, spectrum-polluting, carrier-current technology.

2. Access BPL has proven since the rules were adopted in 2004 to be a failed technology for broadband delivery, despite being touted by the Commission at various times since 2003 as the universal “third pipeline to the home” and the key to rural broadband delivery.⁶ It never was either of those things. The Commission’s December 31, 2010 report on the status of internet access services showed no more than 6,000 customers nationwide receiving service via “power line and other” connections. Yet, at Paragraph 14 of the R&O, the Commission continues to hold, untenably, that it has in this proceeding “established a regime of rules for Access BPL systems that will provide a robust environment for the development and deployment of this important (sic) new (sic)

⁴ Report and Order, FCC 04-245 (“Access BPL Order”), *Amendment of Part 15 Regarding New Requirements and Measurement Guidelines for Access Broadband of Power Line Systems*, 19 FCC Rcd. 21,265 (October 28, 2004).

⁵ It has repeatedly been noted by ARRL that the Commission’s rules governing BPL have no practical application to the interaction between BPL systems and Amateur Radio stations located in residential areas. *None* of what the Commission refers to as “additional limitations” on BPL systems relates to Amateur interference from BPL: The notching capability and frequency agility requirements are not required to be implemented -- only the capability is required. Consultation with licensed users is not required in the case of Amateur Radio; it only applies to public safety systems. Exclusion zones and excluded frequencies do not include any Amateur bands at any location. Access BPL location identification in the public database is, as discussed below, not possible, because the database has *never* been accurate and it is not accurate now.

⁶ With many tens of millions of broadband lines available in the United States, BPL has never enjoyed more than 0.011% of market penetration. At each release by the Commission of an updated Broadband Report, that percentage has been smaller. BPL is not even mentioned substantively in the National Broadband Plan: the only reference is in passing at page 337, noting that BPL was classified as an information service. Yet the R&O, at paragraph 43, states *without quantification* that BPL devices bring “expanded benefits to electric utility companies by allowing them to monitor, and thereby more effectively manage their electric power distribution operations” and ‘last-mile’ delivery of broadband services to some rural and underserved areas.”

technology.” The Commission goes on to observe that, while “there is some potential for increased harmful interference from BPL operations, particularly in locations within a short distance of the power lines used by this technology...” the rules attempt to “minimize instances of interference” while allowing BPL systems to operate “in a viable manner to serve the needs of the American public.” The Commission continues “to hold that, on balance, the benefits of Access BPL for bringing broadband services to the public are sufficiently important and significant as to outweigh the limited increase in potential for harmful interference that may arise.”⁷ The Commission says that it agrees with NTIA that “the potential benefits of Access BPL service warrant acceptance of a negligible (sic) risk of harmful interference that can be managed and corrected on a case-by-case basis.”⁸ Access BPL is not an “important new technology” and never has been; it is old, carrier-current technology that has failed in the marketplace (absent government subsidy) as a broadband delivery mechanism.⁹ The rules that the Commission has established for BPL are insufficient to prevent interference to large numbers of Amateur Radio stations in residential areas, should Access BPL be used in the future for smart grid control. There was never any “balancing” of the interference potential of BPL; there was simply the denial of that interference potential in order that the Commission could continue to represent to Congress and the current administration that it was and is doing everything it can to promote broadband rollout. BPL, using as it does unshielded overhead power lines to carry High Frequency (HF) radio signals, for which those lines were never intended, ubiquitously throughout entire municipalities and for miles along public roadways, obviously merits

⁷ R&O, at ¶ 14.

⁸ NTIA’s statement to this effect was made in 2004, well before it became clear that BPL failed in the marketplace and that its residual potential future application – if any -- is limited to smart grid control.

⁹ The failure of the Manassas, Virginia BPL system is the bellwether illustration of this market failure and of the inadequacy of BPL as a broadband delivery mechanism. When Manassas finally pulled the plug on the municipal system, it was suffering a \$165,000 annual deficit – more than \$300 per customer. Other BPL systems around the country have been quietly shelved or abandoned. Nearly all retail marketing of BPL services has ceased. The singular exception is IBEC, which has continued to promote its system to rural electric cooperatives that qualify for Federal subsidy.

regulatory treatment different from normal Part 15 regulations.¹⁰ The Commission does not impose conducted emission limits on BPL; it atypically imposes radiated emission levels instead.¹¹ This being the case, ARRL has shown in the record that full-time, Amateur band notching, to a reasonable notch depth¹² is standard in the industry now, both with respect to in-premises BPL and Access BPL, though it is not universal in the latter. Obviously, the Commission's rules can and should reflect this standard, because it does not substantially affect BPL systems. It would, however, reduce the interference potential to a level that can be addressed by BPL device operators, electric utilities and radio amateurs on a case-by-case basis. That is not true with the rules as they currently exist. Full-time mandatory Amateur band notching to a reasonable notch depth is needed because the Commission is both unwilling and incapable of addressing BPL interference on a case-by-case basis.^{13 14}

¹⁰ The conducted level of BPL in a number of industry standards is -56 dBm/Hz. In a 50-ohm system, this is a level that is approximately 30 dB higher than the conducted emissions limits for most non-carrier-current Part 15 devices. ***One BPL modem makes as much conducted noise as 1000 other Part 15 devices.*** Assuming that the conducted emissions limit for other devices is appropriate, an increase of 1000 times that noise level is a significant interference potential.

¹¹ At paragraph 25 of the R&O, the Commission states that ARRL's request for 35 dB of mandatory, full time Amateur band notching by Access BPL systems constitutes a request to limit BPL systems to 1/5000th of the levels permitted other unlicensed unintentional emitters. However, most unlicensed unintentional emitters do not meet radiated emission levels. Instead, they are required to meet conducted emission levels. If BPL signals were required to be attenuated to the Class B conducted emission limits applicable to most unintentional emitters consistent with the Part 15 rules, the rules would be sufficient to predictably limit interference potential.

¹² Whether that notch depth is 25, 30 or 35 dB is not as important as mandating full time mandatory notching.

¹³ The Commission has not once successfully resolved documented BPL interference complaints. It failed to take any action to resolve interference complaints from multiple sources in Raleigh, North Carolina; Manassas, Virginia; Emmaus, Pennsylvania; Cedar Rapids, Iowa; Briarcliff Manor, New York; Cottonwood, Arizona; Lee's Summit, Missouri; and most recently, Arrington, Virginia, Fairfield, Virginia, Somerset, Pennsylvania and Martinsville, Indiana. Years have passed between the time of the interference complaints to the Commission and the resolution of the interference, and in each case, that resolution occurred only by virtue of the fact that the BPL system was finally shut down. One of the worst examples was Manassas, Virginia; a BPL system that the Commission hailed as a great success and a validation of the technology.

¹⁴ At paragraph 32 of the R&O, the Commission claims to have contacted the experimental "licensee" of the now-defunct Briarcliff Manor about interference "several times" over the course of its operation and the operator "took steps first to cease operation on the amateur frequencies and then to install new equipment that had notching capability. Subsequent examination of that system by field agents of our Enforcement Bureau found no interference, which substantiates the effectiveness of our rules when properly observed." This is a gross mischaracterization of what occurred. The interference from this system was never mitigated or reduced by the holder of the experimental authorization. The Commission terminated the enforcement proceeding without any action at all. The interference continued unabated until the system was shut down. The Commission's enforcement personnel did not find

II. The Interference Potential of Access BPL is Substantial; the Current Rules are Ineffective in Preventing Interference *Ex Ante*; and Enforcement Remedies are Unavailable and Inadequate as a Substitute for Reasonable Preventative Rules for BPL Interference.

3. The Commission concludes at paragraph 14 of the R&O that there is “some” potential for interference to licensed radio services within “short” distances from power lines radiating BPL emissions. This is a misstatement. Even at 30 meters’ distance from the power lines, assuming that BPL systems set their emissions at the limit specified in the Commission’s Rules,¹⁵ BPL systems are allowed to operate full time across multiple, entire Amateur Radio bands. The limits for BPL are set at levels that are as much as 25 dB greater than the generally accepted median levels of ambient noise in typical residential environments and over 45 dB greater than the quiet rural environment that represents the more quiet times and frequencies within an Amateur band.¹⁶ Nowhere does the R&O address this. It merely discusses whether or not ambient noise levels are increasing or decreasing.¹⁷ Neither does the R&O address many of the sources cited in ARRL submissions following the Court’s remand that show that there is a substantial interference potential from Access BPL to Amateur Radio stations. For example, in Exhibit A to ARRL’s November 30, 2010 *ex parte* submission, ARRL cited a June 20, 2010 report commissioned by the United Kingdom Office of Communications (Ofcom) entitled *The*

interference during their one visit over a two year period because, *as ARRL staff told them at the time*, they did not go to the locations where the interference was reported. Two years of constant interference resulting in Congressional inquiries is not evidence that the Commission’s rules are effective. Instead, the clear inference is that *post hoc* enforcement is unavailable as a remedy for BPL interference.

¹⁵ As ARRL has reported to the Commission repeatedly [most recently on December 30, 2010 with respect to the IBEC (International Broadband Electric Communications, Inc.) BPL systems in southwestern Virginia and one in Pennsylvania], BPL systems, in order to function, must and do operate at levels far higher than those permitted by the Commission’s rules.

¹⁶ To add perspective relative to the median noise levels, a single BPL device makes 317 times more noise than what is found in median noise levels in Amateur HF allocations.

¹⁷ ARRL submitted studies showing that ambient noise levels are decreasing merely to offset the claim by some BPL companies that noise levels are increasing. The levels of man-made noise shown in ITU-R P.372 and the protection criteria of SM 2158 are a reasonable and valid basis from which to protect the Amateur Radio Service from widespread harmful interference.

*Likelihood and Extent of Radio Frequency Interference from In-Home PLT Devices.*¹⁸ This study concluded, in relevant part, that : (1) if demand increases, there will be ***a high probability of interference*** to some existing spectrum users at both HF and VHF by 2020 if PLT device features do not change from those currently implemented; (2) Over the next 5 to 10 years, ***users of sensitive radio systems may increasingly suffer interference from PLT devices***; unless (3) within this timescale, ***in addition to the existing practice of notching International Amateur Radio Union (IARU) bands***, interference mitigation features such as power control and smart notching are implemented in PLT devices. At no point did the Commission address this study or other sources that ARRL cited, showing that BPL has substantial interference potential.

4. The NTIA Phase 1 BPL study¹⁹ made it clear that the interfering signal ranges of BPL signals, even if operated at normal Part 15 levels, are excessive. ARRL experience with many field measurements in BPL interference cases that BPL harmful interference has been noted at Amateur stations with antennas located at distances of ½ mile from the power line. An interference distance of 400 meters from a power line is not a “short distance.” As ARRL has noted numerous times in this proceeding based on NTIA findings, the interference potential from Access BPL in residential areas is essentially 100 percent – and nearly all Amateur Radio stations are located in residential areas. The Commission’s Technical Research Branch concluded, using ARRL surveys that 53 percent of

¹⁸ PLT is “power line telecommunications” (BPL). The report is available in its entirety at <http://www.emcia.org/documents/pltreport.pdf>.

¹⁹ The NTIA study concluded that, at current Part 15 levels, the interference contour of Access BPL systems to land vehicle, boat, and fixed stations receiving low to moderate desired radio signals in the frequency range 1.7-80 MHz is likely in areas extending to 75 meters, 100 meters and 460 meters from the power lines respectively. Further, interference to aircraft reception of moderate to strong desired radio signals is likely to occur at heights up to 6 km altitude within 12 km of the center of the BPL deployment. A reading of these conclusions would lead any reasonable person to conclude that these interference contours are far larger than what the Commission has alluded to. See, *Potential Interference from Broadband over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7-80 MHz*, NTIA Technical Report 04-413 (Phase 1 Study) released April 27, 2004.

Amateur Radio operators who responded to an ARRL survey²⁰ reported that their antennas were located within 30 meters of an overhead medium-voltage power line, and 31% reported that their antennas were within 15 meters of an overhead power line. There is no intervening attenuation of the BPL signal before it reaches the outdoor, high-gain Amateur Radio antenna, typically in the same or a higher horizontal plane as the power line.

5. In the Access BPL Order in 2004, the Commission stated at paragraph 39: “Moreover, the NTIA Phase I study and our own field measurements of Access BPL installations indicate that these systems are not efficient radiators, nor are their emissions cumulative such that they permeate areas in which they are located.”²¹ BPL interference most certainly does permeate areas in which the devices are located because the overhead, unshielded power lines exist throughout residential areas, not just along one line of one roadway.²²

6. Hedging on the interference potential of BPL, the Commission in 2004 adopted only cosmetic, after-the-fact interference mitigation provisions which were either ineffective or inapplicable to Amateur Radio interference, or both.²³ The Part 15 rules were developed, however, upon the fundamental premise that interference will be avoided *ab initio*. The Commission has now reaffirmed the adequacy of its ineffective, post hoc interference remedial scheme, stating at Paragraph 55 of the R&O that:

We are, and were, aware that amateur receive sites are typically located outdoors in relatively close proximity to power lines and that BPL emissions are likely to be present over all or large portions of the amateur bands. These considerations, as well as similar considerations with respect to other services, led us to require that Access

²⁰ <http://www.arrl.org/survey.php3?pollnr=195>. The study was included in its entirety as Exhibit G to the November, 2010 ARRL *ex parte* filing.

²¹ This is both incorrect and irrelevant; the efficiency of the radiator is moot because interference is regulated by radiated emission limits which are not relative to the efficiency of the radiator. No matter how fervently the Commission would have it otherwise, BPL noise decays very slowly along an overhead power line.

²² In areas where access BPL is deployed, virtually every roadway will have BPL systems operating on one or more Amateur bands, regardless of whether BPL repeaters change frequency along the next stretch of roadway.

²³ See Footnote 5, *supra*.

BPL operators be capable of remotely managing their facilities to reduce or eliminate emissions in locations where interference might occur and to require establishment of a database of BPL operations so that licensed radio users could contact the local BPL operator if interference were to occur.

Contrary to the Commission's assumptions, the BPL operator has no incentive to utilize the notching capability unless it is required by the Commission to do so. Experience, including recent experience, shows that they simply don't do it when confronted with an interference complaint. Conversely, when the systems are notched on Amateur allocations, there is typically not a compatibility problem. The Commission, for its part, has made clear by its inaction in interference cases that go on for *years* that it has no intention to conduct any enforcement where there are interference complaints related to BPL.²⁴ And reliance on the BPL database called for by Section 15.615(a) of the rules for anything at all is impossible. As ARRL stated in its comments on the Further Notice at page 59:

The Access BPL database, on which the Commission placed so much reliance as an interference mitigation tool in the Access BPL Order and the Order on Reconsideration, is now and has been virtually useless due to omissions and a lack of updated information...The database is rife with errors, omissions, and listings of BPL systems that are not operating any longer. The database contains entries for systems that have never been placed in operation, and apparently never will be. In other cases...e-mail sent to the contact point in the database comes back as failed mail.

The basic premise for the database -- to permit those licensees receiving harmful interference from BPL systems to be able to contact the system operator and work out some remedy for the interference -- is frustrated. ARRL, in Exhibit D to its written *ex parte* filing in this proceeding dated November 30, 2010, showed that, of 170 zip codes in the United States then shown in the database to have a BPL system operating in them, there were 40 errors that made the entries impossible to utilize. At that time, there were misrepresentations in the database. IBEC for example reported that its systems in all zip codes implemented Amateur band notching, which

²⁴ This is true as well with general power line interference cases. Dozens of these cases, in which power line noise completely precludes Amateur Radio communications, have persisted without Commission resolution for up to 12 years in some cases. Unresolved power line interference cases three or four years old are the norm.

recent measurements then (and now) have proven to be not true. The Commission cannot tout the database as an interference mitigation tool, knowing as it does that the database is unreliable and inaccurate.²⁵ **Exhibit A** hereto discusses the condition of the database at this time.

7. The R&O, at paragraph 101, claims to have addressed the flaws in the database because Commission staff has contacted UTC, one of the managers of the database, and asked that it be cleaned up.²⁶ But the flaws in the database persist nevertheless, and the Commission's reliance on the BPL database puts the lie to its own conclusions. The Commission cites the BPL database, for example, at footnote 144 of the R&O, which discusses the fact that there is but one pending BPL complaint now (concerning an IBEC BPL system). The Commission argues that there are BPL systems now operating in "more than 125 zip codes." In fact, looking at the database, (after one removes the entries for non-existent zip codes that are shown in the database), there are 200 zip codes listed in the online BPL database. None has been added since February of 2011. However, the vast majority of the facilities listed in these zip codes are "paper" systems which were never deployed; systems which were taken out of service; or systems that are in some planning stage which may or may not come to fruition or which are only offering service to customers within a small pilot area. The basis for the Commission's reference in the R&O to 125 zip codes rather than 200 is not explained. The fact is that the database has never been maintained with any degree of care despite repeated complaints and it

²⁵ Some of the errors previously reported by ARRL may have since been corrected but the majority are unchanged in the database. It remains flawed to the point of uselessness.

²⁶ UTC has no ability to do that. It is reliant on information from those few BPL companies now in existence and those which have abandoned BPL as a business plan. ARRL discovered recently in doing field measurements of IBEC systems that two IBEC systems were not included in the database. IBEC admitted to ARRL in correspondence dated January 27, 2011 that, due to what IBEC termed an "administrative oversight," 25 zip codes were not correctly input into the database, and one listed zip code was not in fact served by IBEC. ARRL's November, 2010 *ex parte* filing, noted that ARRL contacted the Shpigler Group in Livermore, CA which reported that it had ceased operation of the system, and had notified UTC of this fact. However, the database was not changed in response to the notice.

cannot serve and never has served as a means of addressing interference *post hoc*, even if *post hoc* interference resolution was practical.

8. That there is but one active interference complaint submitted by ARRL at the present time is not evidence that there is compliance by BPL systems with the Commission's rules; nor an indication of an incentive by BPL systems to attempt to mitigate interference to Amateur Radio stations or to attempt to address interference as it arises; nor an indication that the Commission's existing BPL rules are adequate to prevent interference to Amateur stations.²⁷ There are few active BPL systems, and fewer still that are not implementing full-time notching, so there are few complaints currently. However, the Commission refers in the R&O to a complaint about an IBEC system in southwestern Virginia. IBEC systems in operation in North Carolina, Virginia and Pennsylvania at one time did notch Amateur bands but stopped doing so.²⁸ The failure to notch Amateur HF bands resulted in severe interference to a fixed Amateur Radio station in Virginia. Neither is IBEC notching the United States government bands as required.²⁹ As noted above, ARRL filed a complaint with the Commission on December 30,

²⁷ At paragraph 35 of the R&O, the Commission claims that it did not base its assessment of the interference potential of BPL systems on any standard performance factor, such as an attenuation rate by itself, but rather on the "successful past performance of [its] existing standards and the availability of suitable approaches for managing the potential for harmful interference and correcting any harmful interference that may occur." The Commission cannot, however, as discussed herein, honestly claim that the present rules have been successful in preventing interference from BPL systems to Amateur Radio stations, or in resolving that interference after it occurs. The relative absence of interference cases since the initial rollouts of BPL test systems and initial deployments (which led to large numbers of persistent interference complaints everywhere such systems were deployed) is due to (1) the relative absence of BPL deployments since that time; (2) the willingness of most (but notably not all) of the few remaining BPL companies to notch all Amateur allocations voluntarily; and (3) the fact that the principal remaining BPL company, IBEC, is focused on providing BPL to rural electric cooperatives. Nothing in the reaffirmed BPL regulatory scheme can be said to justify the Commission's assessment of the interference potential.

²⁸ IBEC consistently represented to ARRL that it was notching Amateur HF allocations and demonstrated this in Virginia to ARRL and local Amateurs in Virginia. Its systems are not now notched on Amateur bands and the result has been the Virginia interference report.

²⁹ After ARRL filed its interference complaint with the Commission on December 10, 2010, IBEC claimed in correspondence to ARRL dated January 27, 2011 that although its equipment is notched to protect the "aeronautical bands" as a default setting, it can be adjusted during installation and repair. It claimed that it was "checking and rechecking" all of its equipment to ensure that the systems are rule compliant. However, ARRL's remeasurement of a system using IBEC equipment operated by the French Broad EMC in North Carolina in November, 2011 revealed that it is still not notched on United States government frequencies, in continued violation of the Commission's

2010 noting the interference and other rule violations with respect to three IBEC systems. *It has now been a year since that interference complaint was filed.* No action has been taken by the Commission. ARRL's investigation of the IBEC system showed further that its modems were operating at power levels so far above the permitted maxima that it was apparent that the OFDM-based modems that IBEC uses could not have been properly certified by the FCC Laboratory. On February 10, 2011, ARRL filed a written complaint with the Chief, Laboratory Division, OET, concerning this. No action has been taken and no communications have been received by ARRL with respect to this complaint to date, *ten months later.* All other interference complaints filed with respect to BPL systems from 2004 to date fared similarly. Yet, at paragraph 91 of the R&O, the Commission states: "(w)hether the extrapolation factor is 20 dB or 40 dB or somewhere in between is far less important than the fact that harmful interference must be corrected under any circumstances."³⁰ This Commission apparently is satisfied that its complete inaction over a period of a year on a complaint of BPL interference to a fixed Amateur station that the BPL operator refuses to address voluntarily (by implementation of notching) is consistent with the stated objective of the BPL rules, which is to ensure "...that any instances of harmful interference that may occur can be quickly identified and resolved."³¹ The one conclusion that follows from experience between 2004 and now is this: *in every case where interference to an Amateur Radio station has been experienced from Access BPL, the BPL system has not implemented or not continued to implement full-time notching of all Amateur allocations. BPL systems which have implemented and which continuously utilize full-time notching of all*

unenforced rules, and it and the IBEC systems in Virginia are still operating substantially over the radiated emission limit at the same locations reported in 2010- also in violation of the Commission's Rules. Of course, no Amateur band notching had been implemented either.

³⁰ Commissioner Capps, in his 2006 Statement with respect to the Order on Reconsideration in this proceeding, stated that the Commission "must be available and positioned to respond to interference complaints with alacrity. Amateur operators should not have to wait for months to get complaints resolved – they deserve better."

³¹ R&O, at ¶ 15.

Amateur bands, to a reasonable notch depth, have in general not created harmful interference to geographically proximate Amateur Radio stations. The conclusion from this is obvious.

9. It is readily apparent that (1) the rules are not sufficient as they stand to prevent interference *ex ante*; (2) the interference potential of BPL is far more substantial than the Commission will admit; (3) BPL operators have no incentive to voluntarily resolve interference absent enforcement action by the Commission; and (4) no enforcement can be expected because, *on balance*, the Commission has indicated loudly and clearly that it simply does not care enough about BPL interference to the Amateur Service to expend any significant resources to remedy it.³² The rules must therefore change to address the prevention of BPL interference. BPL companies can, and have, notched Amateur bands full time without adverse consequence. Where this has been done, interference has been prevented.³³

III. Information on Which the Commission Admittedly Relied in Adopting its Insufficient and Ineffective BPL Rules Shows that Access BPL has a Very Substantial Interference Potential, Requiring Full-Time Notching of Amateur Bands.

10. The R&O states that, in general, the Commission is not persuaded by, or disagrees with the voluminous authorities cited by ARRL in its comments and *ex parte* submissions in response to the Further Notice. However, other than ARRL's submissions, the comments of other parties (which do *not* rebut ARRL's technical submissions), and the documents released by Court order on which the Commission has repeatedly stated that it relied in adopting the BPL rules, the Commission has

³² In fact, in the Access BPL Order, the Commission threatened *Amateur Radio operators with sanctions* for filing what it loosely termed "frivolous" interference complaints.

³³ The R&O mischaracterizes ARRL's position (repeatedly). At Paragraph 17, the Commission claims that ARRL "essentially contends that the amateur service should be protected against any possibility of interference" from BPL operations and "demands that BPL operations not be allowed (sic) on frequencies allocated to the Amateur Service." That pejorative characterization is inaccurate. Full time notching of Amateur bands is at this point an industry standard. The Commission requires that the capability to do so be included in all Access BPL modems. Because there is not an Amateur station in every residence, interference is not manifest at all BPL locations, but if the system is using Amateur spectrum unnotched, interference is a *certainty*, and Amateur stations are ubiquitous. Therefore, full-time notching of Amateur allocations is the only preventative solution that will allow BPL to function effectively while not causing interference to Amateur Radio stations.

no other authorities of its own. Therefore, and despite the generalized statements that the Commission “disagrees” with ARRL’s technical filings or that it is “unpersuaded” by ARRL’s submissions, and its disingenuous attempt to distance itself from its own staff studies of BPL’s substantial interference potential, the record does not support a finding that the BPL rules as modified in the R&O are in any sense adequate. The materials released pursuant to the Court of Appeals’ remand order, which the Commission tried desperately not to release to the public, are at substantial variance with the Access BPL Order and the instant R&O post-remand. The R&O addresses this dissonance by discounting the source, mischaracterizing, and attempting to distance itself from the field measurements, studies, and recommendations of its own Technical Research Branch staff, on which it earlier admitted that it relied. The conclusions to be fairly drawn from the studies that the Commission was forced to release by the Court of Appeals are listed at Paragraph 30 of the R&O.³⁴ *See also* **Exhibit B** hereto, a technical critique of the R&O.

11. Former FCC Chairman Michael Powell, the self-professed “cheerleader” for BPL, in a Joint Statement concerning the Access BPL Order, claimed that:

³⁴ These included the following, briefly summarized:

- (1) Access BPL is by no means a point-source emitter; it is a distributive system that has significant interference potential over a wide area, at significant distances from (and along) the power line carrying BPL signals.
- (2) The proper distance extrapolation factor for assumed signal decay with distance from the power line is much closer to 20 dB/decade of distance ($20\log R$) than to the 40 dB/decade of distance adopted by the Commission at frequencies below 30 MHz.
- (3) Access BPL has a high interference potential to licensed radio services, if operated at the maximum radiated emission levels permitted by the Commission’s Part 15 rules. (Interference to licensed mobile radio receivers is very likely for very long distances along a power line. Systems operating at the Part 15 emission limits will be 25-35 dB stronger than the median values of man-made noise at 30 meters distance. Mobile antennas closer to the lines raises the noise level even more.)
- (4) If, in response to an interference complaint, the BPL operator reduced the BPL radiated emission level from the offending portion(s) of the BPL system by 20 dB below the maximum radiated emission level permitted for Part 15 devices generally, mobile facilities would not be protected. That BPL noise would be far higher than the level of ambient noise in residential environments. BPL wideband noise levels would preclude mobile communications long distances from the power line.
- (5) A reasonable course of action at the time was to ban Access BPL on overhead power lines, as a means of protecting licensed services from harmful interference in the High Frequency bands.
- (6) Measurement of BPL radiated emissions should be done at heights not lower than in the same horizontal plane as the overhead power line.

...only minimal regulations are appropriate. However, this does not mean that we have not been cognizant of the need to protect existing licensed services from interference. To address this issue, *the Office of Engineering and Technology (OET) has done thorough testing of BPL systems to ensure the rules we are adopting protect existing governmental uses, amateur radio operators, and other licensees from interference.*” (emphasis added).

The *Access BPL Order* relied heavily on the Commission’s “research,” “investigations,” “field tests,” “field measurements,” and “analyses” to support its conclusion that “BPL network systems can generally be configured and managed to minimize and/or eliminate . . . harmful interference potential.” *See, Access BPL Order* at ¶¶ 2, 23, 39. ARRL’s Freedom of Information Act request *for the test results on which the Commission relied in the adoption of the Access BPL Order* resulted in the release of the tests and studies prepared by the Technical Research Branch. The Court of Appeals, in ordering the disclosure of the unredacted studies, field measurements, “thorough” test results and analyses, held with respect to these documents that “in reaching its ‘low’-likelihood [of harmful interference] conclusion, the Commission stated that ‘(t)he record *and our investigations* indicate that [Access] BPL network systems can generally be configured and managed to minimize and/or eliminate...harmful interference potential [to licensed radio services]”³⁵...The Commission also relied on ‘information provided by our field tests,’ ‘our own field measurements of Access BPL installations’ and ‘our own field testing.’^{36 37} The Court held that the studies released on remand constituted “a central source of data for its critical determinations.”³⁸ The Court made it clear that the Commission chose to rely on these Technical Research Branch studies and measurements, and noted that they were not unauthorized staff activities.³⁹

³⁵ Citation to the Access BPL Order, 19 FCC Rcd at 21266 and 21,322 omitted.

³⁶ *Op. cit.*, 19 FCC Rcd 21275-76, 21282, and 21296.

³⁷ *American Radio Relay League, Inc. v. FCC*, 524 F.3d at 233.

³⁸ *Id.*, 524 F.3d at 245, *citing* Access BPL Order, 19 FCC Rcd at 21266, 21322, 21275-76, 21282, 21296 and the Commission’s 2006 Order on Reconsideration, *Memorandum Opinion and Order* in ET Docket Nos. 04-37, 03-104, 21 FCC Rcd 9308 (2006)

³⁹ *Id.* 524 F.3d at 245, 246. “Under the circumstances, the Commission can point to no authority allowing it to rely on the studies in a rulemaking but hide from the public parts of the studies that may contain contrary evidence, inconvenient qualifications, or relevant explanations of the methodology employed.”

12. Yet, in this R&O the Commission tries to hide from the conclusions of its Technical Research Branch that are “inconvenient truths” at variance with its reaffirmed conclusions with respect to BPL’s interference potential. At Paragraph 3 of the R&O, the Commission concedes only that it “considered” the Technical Research Branch conclusions in establishing the rules. They are referred to as mere “informal presentations”⁴⁰ “of information, impressions and ideas.” It is argued that no formal peer review was conducted, and so the documents were “more properly viewed as discussion materials and options rather than settled conclusions.”⁴¹ Ultimately, the Commission said that the documents constituted the “opinions of one staff member” as to whether BPL systems are point-source systems and “that staff member’s opinion on possible ways to treat these systems.” And the ultimate dismissal: “Also, the assessments and recommendations in the redacted portions of the presentations merely reflect the views of the Laboratory engineers who performed the testing and analysis; they do not necessarily reflect the consensus view of other engineers, the management of the Laboratory or of OET.”⁴² The Commission’s effort to distance itself from the results of its own Technical Research Branch field studies which it secreted; on which it *chose* to rely; and which squarely rebut its findings that BPL has a low interference potential (and thus that no modified rules are necessary to prevent interference), is unavailing under the circumstances. All of the 2003 and 2004 field studies and the July, 2009 documents prepared by the Commission’s Laboratory staff studies were conducted using scientifically valid methodologies and the R&O does not rebut them as a technical matter. As with ARRL’s numerous technical submissions, the R&O simply discounts them. The results of the Technical Branch’s studies and investigations concluded, consistently,

⁴⁰ R&O, at ¶ 8, fn. 26

⁴¹ *Id.*

⁴² *Id.*, at ¶ 19. It is far too late to dismiss these scientifically valid findings and studies as “one man’s opinion”, as the Court of Appeals already noted. The Commission chose to rely on them and it has offered nothing that contravenes the findings.

that Access BPL has a significant harmful interference potential to normal residential Amateur Radio operation.⁴³ Now, the R&O claims (vaguely) at paragraph 19 that the Commission has “considered all of the available information on BPL systems and their performance, submissions in the comments and other publicly available information.” Besides the comments in the record on remand, however, what is that other available information? Why was the other information considered by the Commission not included in the record earlier so that the public could comment on it? Why did the Commission not disclose the information in response to ARRL’s earlier Freedom of Information Act request? The simple answer is that there is no other information.

13. At Paragraph 54 of the R&O, the Commission states that:

We acknowledge that a compliant BPL system will increase the noise floor (sic) within a relatively short (sic) distance of the power lines (typically ranging from less than 15 meters to 400 meters, depending on frequency, type of receive station and location-specific behavior of the BPL operation), and have determined that this increase is acceptable so long as the system’s operation does not cause harmful interference.

The term “relatively short” has no application to interference contours that extend 400 meters from power lines. Almost every licensed Amateur Radio station is located within 400 meters of a power line. A majority of those stations are located within *30 meters* of an overhead powerline. The unquantified “increase in noise floor” is apparently not acceptable if the victim receiver operates in a United States government frequency band. It is only acceptable to the Commission when the victim of the predictably high interference potential is an Amateur Radio station. The Commission states at Paragraph 55 of the R&O that it is:

⁴³ One FCC study, based on actual measurements, showed that Access BPL raises ambient noise levels at substantial distances from the power lines by as much as 40 dB in some cases, and by at least 30 dB in 60 percent of the areas measured, and by 20 dB in essentially 100 percent of the locations measured, at locations typical of the distance between an Amateur radio antenna and an overhead MV power line. The Commission’s Technical Relations Branch concluded that the interference levels would be typically at “25-35 dB.”

aware that amateur receive sites are typically located outdoors in relatively close proximity to power lines and that BPL emissions are likely to be present over all or large portions of the amateur bands. These considerations, as well as similar considerations with respect to other services, led us to require that Access BPL operators be capable of remotely managing their facilities to reduce or eliminate emissions in locations where interference might occur and to require establishment of a database of BPL operations so that licensed radio users could contact the local BPL operator if interference were to occur.

14. The Commission has never adequately explained why Amateur stations, located in residential areas in very close proximity to overhead power lines in grid configurations throughout entire municipalities should not be protected from BPL interference *before it is reported*. The services which are protected *ex ante* by notching requirements are routinely located outside residential areas, typically much farther from overhead medium voltage power lines than are Amateur stations. In the Access BPL Order, the Commission referred to the Amateur Service as a “hobby service” and by that dismissive characterization justified its abandonment of the entire paradigm of unlicensed device regulation as it applied to Amateur Radio. Now, to justify avoidance of advance protection from interference of the licensed service with the *greatest* expectation of interference protection from unlicensed devices, the Commission continues to deny evidence of the interference potential of Access BPL. It claims that there is only a “small” interference potential⁴⁴ which can be resolved after the fact⁴⁵ despite a full and complete record that indicates precisely the contrary. This treatment of licensed radio services is arbitrary and capricious on its face, given the record in this proceeding.⁴⁶ There is a far more compelling case for full-time notching of Amateur

⁴⁴ The NTIA has shown that the interference potential that the FCC refers to as “small” is almost 100 percent at the distances that Amateur Radio stations are typically located from power lines.

⁴⁵ At paragraph 37 of the R&O, the Commission states that it: “did not address the frequencies used by the amateur service on an individual basis, but rather concluded that amateur radio frequencies generally do not warrant the special protection of frequency exclusion that was afforded frequencies reserved for international aeronautical and maritime safety operations.” Nor did the Amateur Service even warrant notification procedures that were applicable to public safety systems located near BPL systems. See Section 15.615(e) of the rules.

⁴⁶ It is impossible to rationalize the implicit finding of the Commission that protection of Amateur Radio communications from interference is somehow accomplished by the adopted rules, while protection of more important services is not, even though those other services (1) are typically located further away from power lines;

bands than there is for any other service in terms of the likelihood of interference from Access BPL systems.

15. The Commission must admit that the majority of BPL systems has implemented full-time, all-Amateur-band notching. It therefore cannot rationally hold that it is a burden on BPL systems to have to do so (to a reasonable notch depth) by rule as a means of protecting the Amateur Service. It claims at paragraph 39 of the R&O that mobile Amateur stations do not need any degree of regulatory protection inasmuch as there are allegedly low signal levels permitted under the Part 15 emission limits and the fact that a mobile transceiver is only in one place for a limited period and “can be readily re-positioned to provide some separation from the Access BPL operation.” As the record shows many times over, however, no after-the-fact interference mitigation can address mobile interference. It must be prevented *ex ante*. After suffering repeated communications preclusion in a wide area where overhead power lines are in a grid configuration, the mobile station could in fact move out of the area, but that would of course be long before any mitigation can be done. During the time the mobile station is in a BPL area, absent full-time notching of the Amateur allocation, the operation of that mobile station will most definitely be repeatedly disrupted and communications precluded. This was proven clearly during the ill-fated Manassas, Virginia BPL deployment, as the Commission’s records and the instant docket record show.⁴⁷ A mobile Amateur station should not have to drive outside an entire city or community in order to be able to communicate.

16. Ultimately, the Commission claims at Paragraph 51 of the R&O that there is no need to require full-time, Amateur band notching:

(2) use receivers of considerably less sensitivity, and (3) typically utilize desired received signals of higher signal strength.

⁴⁷ At paragraph 56 of the R&O, the Commission claimed that its “staff has also made other observations of notched BPL signals, for example at the Manassas, VA system, where notching capability as required under the rules was implemented and was very successful in eliminating interference.” This is a blatantly false statement. There were constant and repeated interference reports from local radio amateurs filed with the Commission noting that interference to mobile Amateur Radio operation was impossible in numerous areas of the deployment area due to BPL wideband noise and incomplete notching.

While some interference is possible at locations close to the power line, we believe that in the great majority of locations, interference will not occur to radio services because either propagation conditions limit the range of the Access BPL emissions or there is no licensed amateur station present and operating on the frequencies on which such emissions appear. We see no need to require an Access BPL operator to reduce emissions below the Part 15 limits where there is no potential (sic) for interference. In addition, we have required that a database of Access BPL systems be established to allow amateur operators to identify BPL operations in their area before the systems commence operation so that they have an opportunity to alert the BPL operator of their presence before the system is activated.

The Commission's suggestion that there are areas where there are no Amateur stations now (and hence "no potential" for interference) ignores the ubiquitous nature of Amateur Radio, and completely fails to prevent interference to mobile stations. The location of Amateur stations is not static; neither the Commission nor the BPL operator can know where an Amateur station will be located and operating at any given time. There is *always* the potential for interference from a BPL system that is not notched on Amateur bands, at significant distances from power lines carrying BPL. At any given location, Amateur stations are likely to be located within the substantial interference distance from an overhead power line carrying BPL.⁴⁸ And as shown above, the BPL database is completely useless and always has been. If *post hoc* remedies were sufficient, this might be a reasonable approach. However, where interference complaints have consistently been unaddressed where they arise; where the capability to notch to any reasonable notch depth is meaningless because it is not implemented, and where the Commission has shown a universal

⁴⁸ The Commission, at paragraph 43 of the R&O, states that it "acknowledge(s) ARRL's point that the modeling in the *NTIA Phase 1 Study* predicts that Access BPL emissions on frequencies below 30 MHz that are at the Part 15 limit would raise the mobile radio noise floor at 15 MHz and 25 MHz by 30 dB in 59% of residential locations." However, the Commission claims that the noise level varies by location. The same NTIA study, however (and the Commission carefully avoids any reference to this in its R&O) predicted that the interference contour of a BPL system to a fixed Amateur station trying to receive low-to-moderate signals at HF (the normal situation) could expect to receive interference at a distance of 460 meters — a distance of nearly five football fields — from the power lines, even assuming that the BPL devices met the radiated emission limits in existing Part 15 regulations. ARRL's experience and extensive field investigations, many of which have been reported to the Commission, are entirely consistent with this finding.

proclivity to ignore BPL interference cases when brought to its attention, the need for full-time notching, which is not problematic for BPL systems, is manifest.⁴⁹

17. That full-time Amateur band notching is both possible and necessary is illustrated by the case study discussed at Exhibit A, page 26 of ARRL's November, 2010 *ex parte* submission. ARRL stated, with respect to the IBEC BPL system in Lovington, Virginia, as follows:

IBEC also initially completely notched the ham bands in its deployment in the Central Virginia Electric Cooperative in and around Lovington, VA, in preparation for testing done by local Amateurs in that area...Although notch depth was not measured during that evaluation testing, the local Amateurs reported that the universal notch filtering implemented by IBEC system-wide at that time in preparation for this testing was effective in preventing widespread interference problems involving Amateur Radio...

Unfortunately, contrary to the provisions in the IEEE P1901 standard, and its early assurances to ARRL and local Amateurs in its Virginia deployment area, IBEC has stopped following industry practice with respect to notching the Amateur bands, despite the positive EMC results it had in its Virginia system when universal notching was employed. This is a clear indication that, industry assurances notwithstanding, and even with IEEE standards in place that require that Amateur bands not be used for BPL, without a mandate in regulations that mirrors this industry-standard practice, some BPL operators will not follow industry standards and will deploy systems that cause interference to Amateur Radio operation.

As demonstrated by recent interference complaints and ARRL testing, IBEC has discontinued the practice that it had used to demonstrate that its notching resulted in systems did not cause harmful interference to Amateur Radio. After this demonstration, in contradiction to its entries in the BPL database, IBEC has chosen to use the Amateur spectrum its database entries indicate that it is not using. The result is predicable – in the BPL system deployed by IBEC in the Central Virginia Electric Cooperative, interference levels on the Amateur bands are strong over the entire service area.

IBEC has, to a degree, implemented notching in and around fixed Amateur stations that have filed formal complaints, but the local Amateurs indicate that the process of trying to implement notching on a case-by-case basis has been a difficult and iterative one, sometimes taking months to implement. Once notching is implemented, if a new customer signs on to the IBEC service near the licensed Amateur, based on a report of an Amateur in the Lovington area, the process must be repeated again and again.

This establishes empirically that full time mandatory notching of Amateur bands to a reasonable notch depth should be required by the Commission's rules.

⁴⁹ ARRL established at pages 7-12 in its June, 2011 *ex parte* filing in this proceeding in response to the UTC two-page, unsupported letter filing dated May 4, 2011 that full time notching can be done without any substantial loss in data rate, and that such notching is supported by worldwide industry standards. In some cases, notching spectrum that is being affected by strong interference improved the data rate. Why the Commission finds that showing and the cited standards to be unpersuasive is not explained in the R&O.

IV. Any Variability in the Median Noise Level, and Any Variability of the Decay of RF Fields Near Power Lines Militates in Favor of Requiring Full Time Notching of Amateur Bands By BPL Facilities, and Vitiates the Commission’s Measurement Procedures.

18. The Commission claims repeatedly, in an attempt to rebut ARRL’s earlier arguments concerning the proper notch depth for BPL modem “capability” that at HF “there is considerable variability around the median noise level, such that increases of as much as 20 dB are common and reduce the reliability of signals at the margin of expected reception. *R&O*, at ¶ 43. At paragraph 11 of the R&O, it claims that there is variability in the attenuation of emissions from BPL systems across individual measurement sites that are not captured by a uniform 40 dB/decade extrapolation factor for signal decay. Given the unpredictability of BPL radiated emission field strengths at distance claimed by the Commission, it is apparent that the Commission can make no assumption with respect to the level of interference at distance from radiating medium voltage power lines. This strongly militates in favor of requiring full-time notching of Amateur bands, even if only to the 25 dB notch depth adopted by the Commission in this proceeding.

19. Given the variability in signal decay claimed by the Commission,⁵⁰ it is readily apparent that the Commission’s site-specific measurement procedure adopted for BPL systems, which requires measurement at only four points along the BPL system, is woefully inadequate⁵¹ in order to assess the actual compliance level of the BPL system.⁵² Furthermore, the Commission has adopted the “slant range distance” used in the BPL measurement guidelines (which did not heretofore appear in the BPL rules) for measurement of BPL radiated emission levels. The Commission holds at

⁵⁰ See paragraph 68 of the R&O.

⁵¹ This can be fixed. The present rules support measurement of extrapolation using 3 points. This works for physically small emitters. The complex pattern of emissions from large emitters does not suit this method. If, however, measurements are made at 4 horizontal distances perpendicular to the line at specified distances *along* the line, and the maximum value is used at each horizontal distance is used in the calculation, the methodology is scientifically justified.

⁵² Given the extreme variation in field strength near a large complex radiator, an *in situ* measurement procedure that permits measurements along the ground at only four unspecified points invites “cherry-picking” and allows BPL systems to freely operate well above the permitted radiated emission maxima.

paragraph 2, footnote 7 of the R&O that because Access BPL devices are mounted on overhead power lines and the measurement antenna is at a lower distance closer to the ground, the actual distance from the power line to the measurement antenna is greater than the horizontal distance from the pole on which the BPL device is mounted to the measurement antenna. The correct distance for measurement is therefore the “slant range” diagonal distance measured from the center of the measurement antenna to the nearest point of the overhead power line carrying the Access BPL signal being measured. While this is a slight improvement over measurement at horizontal *distance* from the power line, the Commission has ignored ARRL’s point, made repeatedly in the pre-and post-remand docket proceedings that emissions above the power lines are stronger than they are at ground level. Therefore, the measurements made at ground level are misleadingly low.⁵³ The NTIA Phase 1 study recommended measurement of BPL emissions at a *height* roughly equal to the power line height, using an adjustment factor for higher emissions at higher elevation angles, but the Commission did not adopt the recommendation.

V. The Distance Extrapolation Factor.

20. The bulk of the R&O is dedicated to justifying the Commission’s reaffirmation that the 40 dB/decade of distance extrapolation factor is justified, in lieu of the proposed 30 dB/decade extrapolation factor in the Further Notice or some other figure. ARRL submitted voluminous materials in the record in this proceeding, the scientific validity of which ARRL continues to maintain. However, the Commission held at Paragraph 71 that:

Initially, we observe that the 40 dB/decade extrapolation for frequencies below 30 MHz has served successfully in our program to control emissions from radio frequency devices for many years. We also observe that, while ARRL contends that 20 dB is the only scientifically correct and valid value for an extrapolation factor, the

⁵³ The R&O states at ¶ 31 that “(a)nalysis and prediction of RF propagation in the HF frequency region is extremely complex and difficult, and particularly at locations close to the ground, as the Commission, ARRL and many other commenters have acknowledged throughout this proceeding.” At paragraph 33, the Commission admits that there is free space propagation upward from radiating power lines.

studies and information before us show considerable differences in extrapolation factors under various power line system configurations and usage conditions. We conclude that there is no single “correct” value for an extrapolation for RF emissions from power lines, and instead find that the compelling and reasonable solution is to use the existing Part 15 extrapolation factor that both has a scientific basis and has stood the test of time for a wide variety of devices and systems. We also note that, as discussed below, using the slant range method in performing measurements has the effect of reducing the extrapolation factor to approximately 20 dB...

ARRL **at no time** asserted that 20 dB/decade was “the only scientifically correct and valid value for an extrapolation factor.” ARRL has only insisted that the Commission adopt a scientifically valid and supportable extrapolation factor. ARRL is of the view, and the record shows via extensive and definitive studies and analyses⁵⁴ that the correct extrapolation factor is *close to 20 dB/decade in the region beyond wavelength/2Pi of distance from radiating BPL systems*. The Commission had in its possession in 2004 and in 2006, at the times that it adopted and first affirmed the 40 dB/decade factor, firm evidence that 40 dB/decade is not the correct extrapolation factor. ARRL incorporates herein by reference the studies and arguments previously submitted on that subject. That said, ARRL has also taken the position that the extrapolation factor is less significant as a practical matter if there is full time notching of Amateur bands by Access BPL facilities to a reasonable notch depth. It is unfortunate, however, that the Commission, unwilling to impose any restrictions on BPL systems regardless of the record evidence, and lacking an unambiguous scientific basis for a single value that would be applicable across the entire 1.7 to 30 MHz frequency range, fell back on the only single value for an extrapolation factor that is scientifically unsupportable.

⁵⁴ See, e.g. Hare, Ed, *Modeling as an Alternative to Measurements in Determining the Extrapolation of Measurements Below 30 MHz*, Exhibit C to ARRL’s Comments in this proceeding filed September 23, 2009; Hare, Ed, *Industry Standards Addressing Distance Extrapolation*, Exhibit D to ARRL’s Comments in this proceeding filed September 23, 2009; and Hare, Ed, *Rationale for the Abandonment of the Use of a Single 40 dB/decade Extrapolation Factor for Radiated Emissions Measurements Made Below 30 MHz*, Exhibit A to ARRL’s written *ex parte* submission in this proceeding filed January 11, 2010.

VI. Conclusions.

21. While BPL has failed in the marketplace as a medium for delivering broadband connectivity to consumers, the technology is still touted as a mechanism for “smart grid” applications. It is time that the Commission stopped stonewalling with respect to (1) the unique and substantial interference potential of Access BPL systems relative to Amateur Radio HF communications; (2) the inapplicability and/or inadequacy of the current BPL rules to Access BPL/Amateur Radio interaction; (3) the clear necessity of mandatory, full time notching by Access BPL companies of Amateur Radio allocations to notch depths of *at least* 25 dB; and (4) the absence of any negative effect on BPL systems of the obligation to maintain full-time notching of Amateur bands. Mandatory full-time Amateur band notching to 25 dB should be implemented right now.

Therefore, for all of the above reasons, ARRL, the National Association for Amateur Radio, respectfully requests that the Commission reconsider and modify the rules governing Access Broadband over Power Line systems in accordance with the foregoing.

Respectfully submitted,

**ARRL, THE NATIONAL ASSOCIATION FOR
AMATEUR RADIO**

225 Main Street
Newington, CT 06111-1494

By: Christopher D. Imlay
Christopher D. Imlay
Its General Counsel

BOOTH, FRERET, IMLAY & TEPPER, P.C.
14356 Cape May Road
Silver Spring, MD 20904-6011
(301) 384-5525

December 20, 2011

Exhibit A

Errors in the United Power Line Council BPL Database: Second Report

ARRL HQ Staff
225 Main St.
Newington, CT 06111
December 20, 2011

The following report describes the condition of the BPL database as of December 19, 2011.

On November 20, 2010, ARRL filed a complaint with the Commission about the large number of errors that existed at the time in the United Power Line Council (UPLC) BPL database, located at <http://www.bpldatabase.org>. [UPLC has since been dissolved as a functioning organization, but has been absorbed by its parent organization, the Utilities Telecom Council (UTC)]. This complaint was accompanied by an exhibit, “Errors in the United Power Line Council BPL Database.”

That report outlined errors and omissions in the BPL database. It also described a number of BPL systems that were entered into the database, but were paper systems that did not ever exist. The majority of these errors were self-evident and would have – and should have – been identified by even minimally competent administration of the database.

Although some of the errors reported by ARRL over one year ago have been corrected, many obvious errors remain. These errors, known to UTC and FCC for over a year, seriously diminish the ability of the BPL database to serve as a reasonable tool for use in identifying BPL interference.

There are 171 ZIP codes in the United States that have a BPL system entry in the database.¹ ARRL easily identified errors in 44 of them. This represents a continuing error rate of 26% of the ZIP codes containing *easily* identified errors. There may be other errors that are not apparent from the data or from a “failed-email” error message.

The following BPL operators were contacted by ARRL, but did not respond to ARRL’s inquiry:

- New Visions – Recent media reports in the free press indicate that New Visions is no longer operating any BPL in the central NY region. From all indications, these BPL systems have never been in operation.
- Gridline BPL systems have never been in operation.

¹ This number is somewhat lower than it was in ARRL’s report and complaint from November 2010 because a block of BPL ZIP codes in Texas for which BPL service was discontinued has been removed. Many other “phantom” systems still remain in the database, however.

Summary of number of ZIP codes with errors:

- System known to be shut down but still listed in database: 36
- System known to be shut down but still listed in database for which the operator of record has confirmed to ARRL that he has informed UPLC that he is no longer the operator of the system: 1
- Contact information email invalid: 19. These systems appear to be no longer in operation.
- Missing frequency, model or other information: 2
- Invalid ZIP code or other: 2

ZIP code	City, State	BPL operator	Error	Notes
01104	Springfield, MA	Amperion	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	This system has not been in operation for 2+ years. This discrepancy was previously reported to the FCC and UTC.
11520	Freeport, NY	Freeport Electric	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	
12345	Washington, DC	Test Company	Not a valid ZIP code	UTC is leaving a test entry in the database
13209	Solvay, NY	New Visions	The contact person in the database did not respond to an ARRL request	Media reports in the free press indicate that New Visions is no

			for information.	longer operating any BPL in the central NY region. From all indications, these BPL systems have never been in operation.
13219	Syracuse, NY	New Visions	The contact person in the database did not respond to an ARRL request for information.	Media reports in the free press indicate that New Visions is no longer operating any BPL in the central NY region. From all indications, these BPL systems have never been in operation.
13421	Oneida, NY	New Visions	The contact person in the database did not respond to an ARRL request for information.	Media reports in the free press indicate that New Visions is no longer operating any BPL in the central NY region. From all indications, these BPL systems have never been in operation.
13461	Sherrill, NY	New Visions	The contact person in the database did not respond to an ARRL request for information.	Media reports in the free press indicate that New Visions is no longer operating any BPL in the central NY

				region. From all indications, these BPL systems have never been in operation.
18015	Bethlehem, PA	PPL Telecom	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	
20110	Manassas, VA	City of Manassas	Although this system appears in the BPL database, the BPL operator has announced that the system is no longer in operation.	
20164	Sterling, VA	Copper Road	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	The domain name in the contact email address, CopperRoad.com, is listed as being for-sale
20165	Sterling, VA	Copper Road	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail,	The domain name in the contact email address, CopperRoad.com, is listed as being for-sale

			unknown user.	
20166	Sterling, VA	Copper Road	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	The domain name in the contact email address, CopperRoad.com, is listed as being for-sale
20167	Sterling, VA	Copper Road	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	The domain name in the contact email address, CopperRoad.com, is listed as being for-sale
22921	Unknown presumed VA	IBEC	ZIP code is not a valid ZIP code.	
24141	Radford, VA	Designed Telecommunications	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	
24153	Salem, VA	Designed Telecommunications	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	

27709	Durham, NC	Copper Road	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	The domain name CopperRoad.com is listed as being for-sale
27825	Everetts, NC	Copper Road	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	The domain name CopperRoad.com is listed as being for-sale
27892	Williamston, NC	Copper Road	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	The domain name CopperRoad.com is listed as being for-sale
28226	Charlotte, NC	Current	There is no model or frequency information listed.	
28277	Charlotte, NC	Current	There is no model or frequency information listed.	
32208	Jacksonville, FL	Jacksonville Electric Authority	Although this system appears in the BPL database, the BPL operator has confirmed that the system is	

			no longer in operation.	
32209	Jacksonville, FL	Jacksonville Electric Authority	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	
43402	Bowling Green, OH	Amperion	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.	
48813	Charlotte, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	This system was taken out of service in November 2007. The BPL database has been inaccurate with respect to this system for over three years and through several reports of the error to the FCC and UTC.
48820	DeWitt, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is	This system was taken out of service in November 2007. The BPL database has been

			no longer in operation.	inaccurate with respect to this system for over three years and through several reports of the error to the FCC and UTC.
48822	Eagle, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	This system was taken out of service in November 2007.
48837	Grand Ledge, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	This system was taken out of service in November 2007
48861	Mulliken, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	This system was taken out of service in November 2007
48866	Ovid, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in	This system was taken out of service in November 2007

			operation.	
48875	Portland, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	This system was taken out of service in November 2007
48876	Potterville, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	This system was taken out of service in November 2007
48879	St Johns, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	This system was taken out of service in November 2007
48906	Lansing, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is no longer in operation.	This system was taken out of service in November 2007
48917	Lansing, MI	Utility.net	Although this system appears in the BPL database, the BPL operator has confirmed that the system is	This system was taken out of service in November 2007

			no longer in operation.
63701	Cape Girardeau, MO		The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.
63702	Cape Girardeau, MO	Ameren UE	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.
63703	Cape Girardeau, MO	Ameren UE	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.
63705	Cape Girardeau, MO	Ameren UE	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.

70807	Baton Rouge, LA	PowerGrid	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.
70810	Baton Rouge, LA	PowerGrid	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.
72064	Hazen, AR	PowerGrid	The contact information for the BPL operator is incorrect. Email sent to the address provided is returned as failed mail, unknown user.
94551	Livermore, CA	The Shpigler Group	The contact information for the BPL operator is not correct. In response to ARRL's inquiry, Shpigler promptly responded, directing ARRL's inquiry to PG&E.
98847	Peshastin, WA	Chelan PUD	The BPL system is still in the

database,
although ARRL has
confirmed that it
is no longer in
operation.

Exhibit B

**THE TECHNICAL COMPONENT OF THE RECORD IN THIS PROCEEDING, AND
THE SECOND REPORT AND ORDER**

By Ed Hare, W1RFI, Laboratory Manager, ARRL

December 14, 2011

The FCC claims that it is not persuaded by ARRL's technical submissions filed in response to the Further Notice of Proposed Rulemaking; there are "additional" considerations that previously led the FCC to reach different conclusions. In the Second Report and Order, the FCC states that it has not reached different conclusions than it reached in the first Report and Order. (Paragraphs 18, 19)

The ARRL's submissions in response to the Further Notice of Proposed Rule Making and in Written Ex Parte Filings represent a strong record that effectively makes the following points:

1. Contrary to the FCC's claims, the radiated emission limits that apply to carrier-current systems are high. Those limits are approximately 30 dB greater than the current median levels of man-made noise, and as much as 50 dB greater than the minimum noise levels found in today's EMC environment. It is common for a frequency-agile service such as the Amateur Radio Service to select frequencies within its allocated bands that are at those minimum noise levels. Man-made noise also typically varies over time, allowing licensed radio services to select operating times that have lower noise levels. Man-made noise also varies considerably with location, over relatively short distances, allowing licensed radio services that have the ability to select operating locations to choose to operate from locations that have low noise levels.¹

2. BPL is a broadband emitter with a power-spectral distribution that is uniform over frequency, relative to the typical bandwidth of licensed receive systems operating in its frequency range. This completely eliminates the frequency variation that is typical of most man-made noise. As a result, stations operating in the Amateur Radio Service cannot take advantage of the frequency agility that protects its operators from some man-made noise.

3. Access BPL operates continuously over time, as does some in-premise BPL technology (generating idle carriers when the BPL modem is powered on, but not in actual use). This completely eliminates the time variation that is typical of most man-made noise. As a result,

¹ It is common for operators in the Amateur Radio Service to make very specific choices as to where they will live and operate, based on the ambient noise levels present at a particular location.

stations operating in the Amateur Radio Service cannot use time to protect itself from BPL-caused man-made noise.

4. Contrary to what the FCC claims, BPL *is* a distributed emitter, and although noise near the injection point is several dB stronger than it is up and down the line, the record on quantitative measurements is clear; BPL emissions decay only *slowly* with distance along the line. This is strongly supported by the qualitative record as well, with both FCC and ARRL video recordings documenting that in the areas where BPL is deployed, BPL operates at a level that is many dB stronger than most of the desired signals routinely used in the Amateur Radio Service.

5. Operation of BPL at the current emissions limits will cause strong interference to nearby radio users if BPL is using spectrum that is in use locally. Avoiding the use of any spectrum that is in use locally by notching is the only way that BPL operators can meet their obligation to not cause harmful interference to licensed radio services. In the case of a radio service whose stations do not operate only from a single fixed location (e.g. Amateur, Citizens and the reception of international shortwave broadcast transmissions), it is not possible to address interference after the fact. When an access BPL system is deployed, it will operate over most, if not all, of a large geographical area. If harmful interference occurs over a matter of the days, weeks or months that it would take for BPL operators to address interference to permanent fixed Amateur stations, it has indeed “seriously degraded” the operation of a fixed, mobile or temporary fixed station that was not able to operate over a significant period of time, over a large geographical area. Once that interference has occurred, and not been resolved before it was made moot by relocation of the victim receiver, it cannot be corrected after the fact and the system would be left exactly as it was originally configured, causing the same harmful interference to the next licensed user that tried to operate on those bands in that large geographical area.

FCC claims:

(1) The present rules provide “an effective means of limiting harmful interference” from BPL and “ensure that any instances of harmful interference that may occur can be quickly identified and resolved.” The rules are “adequate and appropriate” and additional material does not demonstrate a need to change the rules. (Paragraphs 15, 21, 26, 32, 34, 38).

(2) There is little likelihood that harmful interference would occur from access BPL operation at the current radiated emission limit. (Paragraph 23).

(3) Some operation may occur at distances sufficiently close to lines carrying BPL to make harmful interference possible (Paragraphs 14, 21).

(4) FCC agrees with NTIA that some cases of harmful interference “may be possible” and that the acceptance of a “negligible risk” of interference is justified (14).

FCC position: The current emissions limits will restrict BPL to low levels in comparison to the signals of licensed radio operation (Paragraph 21).

(5) FCC disagrees that recently released material shows the interference potential from BPL to be greater than it anticipated in the Access BPL Order (Paragraph 26).

(6) BPL will be required to cease operation if it causes harmful interference and/or BPL operator must resolve interference if it occurs (Paragraphs 15, 54).

BPL noise levels are 30 to 50 dB higher than the existing, generally accepted levels of man-made noise. The existing man-made noise levels stem primarily from incidental emitters and the conducted noise levels of non-carrier-current unintentional emitters. Not coincidentally, the permitted conducted noise levels from most unintentional emitters is 30 dB lower than the levels that BPL uses in practice (and which presumably represent the level of noise that will result in the radiated emissions limits that BPL must meet). An increase of noise levels of 30 dB or more is neither insignificant nor acceptable. Were it otherwise, conducted emissions limits for all types of devices could be raised by the same 30 to 50 dB. There has never been a serious request from industry to raise the conducted emissions limits because most industry knows that the present levels of man-made noise DO represent a reasonable “acceptable” risk of harmful interference and they *know* that an increase of 30 dB would result in widespread interference instances.

The record does *not* show that BPL noise is “low” with respect to the signal levels used by licensed radio services on HF. Graph after graph of measured “before and after” results show the wide range of desired, licensed signals used on HF and the fact that BPL operating at the FCC limits completely masks all but the strongest of those signals. BPL noise may be somewhat lower than some of the strongest HF signals, but it still degrades the desired signal significantly. It would *not* be acceptable to anyone of their favorite radio station were still audible, but had a clearly audible noise present at all times. This is exactly what happens to the strongest signals on HF with “legal limit” BPL operating nearby. Other weaker signals that would still be quite usable are simply completely obliterated by BPL noise.

The FCC admits that the interference level shown in the FCC video documentation of the Ambient Briarcliff Manor system is unacceptable, yet this unacceptable level is well documented in the majority of the filings in this proceeding.

FCC claims that “BPL systems will be required to cease operation” if harmful interference occurs, but the fact of the matter is that despite a number of repeated complaints

about interference at various BPL systems (whether operating pursuant to Experimental² authorizations or pursuant to Part 15 rules), the FCC has not once ordered that a system be shut down or notched, despite harmful interference that persisted for many months.

FCC claims that IBEC has implemented systems and resolved interference problems within the framework of existing rules. (Paragraphs 48, 69)

IBEC has *not* operated its systems within the framework of the existing rules. It has implemented systems that were not entered into the BPL database (claiming an administrative oversight); it has implemented systems that did not (and still do not) meet the FCC emissions limits; it has certificated equipment (which were supposed to be tested as required at the maximum operating level) that operates at levels as much as 40 dB higher when deployed in the field than permitted by the Part 15 rules; it made material misrepresentations to ARRL and to local radio amateurs about its intent to use full-time notching of the amateur bands, demonstrating the same to ARRL and others locally, and then did not implement that notching as it had promised. The misrepresentation was repeated and persisted for over a year in the FCC database. IBEC has since made half-hearted attempts at protecting *some* stations operating in the Amateur Radio Service, although those amateurs report that the corrections they have made have still left degraded noise levels and that somehow, the interference keeps recurring, presumably as new customers are added, necessitating successive rounds of complaints. IBEC has also told at least one complainant that reported interference to his mobile HF station (which had been operated for years prior to the BPL installation) that there is nothing IBEC can or will do to protect his mobile operation, despite the fact that the minimal protection level of 20 dB below the emissions limits was not applied in the communities in which the victim amateur was previously able to regularly conduct HF mobile operations.

IBEC is *not* a good example for compliance with the rules. To the contrary, although the FCC makes an attempt to justify each individual component to its present rules, few of the interference mitigation proposals apply to Amateur Radio stations. Those that do, taken *in toto*, are easily subverted by the BPL operator, as was seen in the case of IBEC. The rules are therefore a failure. Were IBEC the only bad example, one could argue that the rules are still valid, but one operator is not following them. The overall record shows that BPL systems

² The premise in the 2nd Report and Order that because some of the systems for which complaints were filed were Experimental stations the complaints do not have applicability to the existing rules because those systems did not have the protection of the existing rules is a red herring. The emissions levels of the Experimental systems were the same as Part 15 and extrapolation was presumably done the same way. Experimental operation has a provision about ceasing operation that is *stronger* than Part 15. The experiences with the early Experimental systems are completely applicable to the present rulemaking and must be considered.

consistently operate above the limits, using equipment that was ostensibly certified to operate at or below those limits. These operators have an abysmal track record of responding to interference reports with denials and, in some cases, responses that appear to be entirely fabricated.

FCC claims that ARRL's request for -35 dB notch depth is 1/5000th of the levels permitted for other devices (Paragraph 25).

This statement misinterprets the existing rules, largely by omission. The FCC's statement is true with respect to the levels permitted for other carrier-current devices, but BPL systems are the *only* carrier-current devices that operate over such a wide swath of spectrum. Access BPL systems are the *only* carrier-current devices that are part of systems that can be as large as an entire State. The vast majority of "other devices" that are regulated by existing radiated emission limits are non-carrier-current unintentional emitters. These devices are governed by the conducted-emissions limits in Part 15 rules, and the levels that ARRL is seeking for notch depth correspond very well to the current Part 15 conducted emissions limits. It would be more accurate to say that ARRL is seeking notch-depth protection that is equal to the conducted emissions levels for other devices.

This demonstrates the wide difference between the present rules for non-carrier-current devices and carrier-current devices such as BPL. If one presumes that the operating level of various BPL modems, identified by the manufacturers as operating at levels plus and minus a few dB from -56 dBm/Hz correspond to the radiated emissions limits, then BPL operating at those levels is operating at a level that causes one BPL modem to make as much noise as 1000 other unintentional emitters.

At HF, ARRL has measured BPL systems operating 20 dB or more above the carrier-current limits. In those cases, one BPL modem was making as much noise as 100,000 other unintentional emitters, again over a very, very broad area.

FCC's claim that the video interference shown from ARRL's videotape of Briarcliff Manor is not acceptable and would not be permissible under the Part 15 rules (Paragraph 32).

BPL operating at the radiated emission limit does cause harmful interference on any spectrum that is in use nearby, especially to stations operating in the Amateur Radio Service. FCC conceded this in the 2nd R&O when it claimed that the video evidence gathered by FCC staff in Briarcliff Manor, NY did indeed show levels of noise that represented unacceptable

interference. FCC did not make measurements of the radiated field strength at the locations shown in the video, but ARRL did. Although there were a number of places in the Ambient Briarcliff Manor system that were operated above the FCC limits, the emission levels on the majority of the street where that video was made were approximately at the Part 15 radiated emission limits. The same thing is seen in the ARRL videos from that system, as well as ARRL staff experience in Agawam, MA; Shelton, CT; Briarcliff Manor, NY; Manassas, VA; Allentown, PA; Rochester, MN; Rock Hill, NC; Charlotte, NC; Penn Yan, NY; Bowling Green, OH; Cottonwood, AZ; San Diego, CA; Miami, FL; Lovingson, VA; Cedar Rapids, IA; Cape Girardeau, MO; Lee's Summit, MO and Houston, TX. Video documentation driving down the road was not made by ARRL at each of these locations, but unbiased witnesses of the effect of BPL on local HF communications have without exception reached the same conclusion – the level of interference that the FCC deemed to be unacceptable from the Ambient system in Briarcliff Manor NY was seen in *all* of the BPL systems cited above, operating at levels that approximately represent the current BPL limits. There was nothing unique at all about the FCC Briarcliff Manor video – it shows what BPL systems do. The exceptions to this experience with respect to Amateur Radio were seen in the systems that notched the amateur bands, such as the Current Technologies systems in Cincinnati and other locations, the Ambient system in San Diego and the systems that, often after being confronted with serious interference problems, chose to implement full-time notching for the amateur bands.

FCC claim that the ITU-R SM.1879 recommendation of 0.5 dB increase was not justified (Paragraph 44).

While the FCC was quick to embrace an IEEE standard which the most authoritative IEEE Society rejected out of hand, the FCC has inexplicably rejected a directly applicable and universally acknowledged ITU-R Recommendation. The level of 0.5 dB protection that is in this ITU-R Recommendation is not unique to the Amateur Radio Service. It is a protection level that is found across a wide range of internationally allocated services and serves as the basis on which international regulations are crafted for those services. ITU-R Recommendations are not justified; they serve as the authoritative basis on which domestic regulations, and justifications for them, are built. The FCC's dismissal of this ITU-R Recommendation as unjustified demonstrates that its focus is on a desired outcome.

FCC claim that it recognized the critical nature of aeronautical service and the free space propagation from power lines to overhead aircraft (Paragraph 33).

FCC is correct in holding that BPL emissions upward from power lines are greater than those along the ground. Each premise outlined in paragraph 33 applies equally well to any radio service whose operators routinely use antennas located at heights greater than the power lines.

FCC disagrees that resolving interference is difficult because the BPL database will make resolution of interference easy (Paragraph 55).

Resolution of BPL interference has never been easy. In case after case, even the current cases involving IBEC, the BPL industry has consistently avoided having to address harmful interference after it has been reported. Amateurs have had to make repeated measurements, made repeated mitigation requests, and filed formal complaints with the FCC, but in most cases, the resolution (if any) of the interference was only partial or temporary at best. The vast majority of interference problems were resolved when the BPL system shut down for financial or technical reasons, or implemented full-time Amateur band notching.

FCC argues that the radiated emission limit in the Access BPL Order will increase noise only for a short distance from power lines (15 to 400 meters). ARRL allegations that *ex ante* prevention is required were considered and rejected because FCC data showed that the area of interference was only “close to and along” power lines (Paragraphs 50, 51, 54).

If the NTIA Phase I report is correct (and FCC has never indicated that it is wrong), then a significant (nearly 100%) likelihood of harmful interference exists within 400 meters of power lines carrying BPL signals. Within that area, most Amateur Radio receivers subject to BPL interference are potential victims. If BPL were ubiquitously deployed, at least 95% of amateur stations are “close to” power lines, and thus although interference would not occur at all locations where BPL is deployed, it would occur at the vast majority of locations where amateur stations are present. For any radio service that can and does have operation from unspecified, sometimes temporary locations, the track record of most interference taking weeks to months to resolve simply cannot be used to address interference to mobile and portable amateur operation. If BPL interference were like other interference sources, and very limited in geographical scope, one could reasonably take the position that those that choose mobile or temporary portable operation locations need to consider the presence of local noise in making their choices. But for access BPL, where interference on several or all HF amateur bands would be present over a very large geographical area representing an electric utility’s service area, that choice simply does not exist. The only way to avoid causing harmful interference to radio services for which it is not possible to determine in advance the locations of licensed operators is to avoid the use of spectrum that they are licensed to use.

The FCC Decision to Reaffirm the 40 dB/decade of distance Extrapolation factor.

FCC positions:

- (1) FCC rules on signal decay extrapolation are based on the “successful past performance” of existing standards (Paragraph 35)**
- (2) 40 dB/decade is a successful and existing standard practice**

ARRL, other commenters and the large number of standards and ITU documents show clearly that a straight 40 dB/decade distance extrapolation is not correct. These studies, ARRL comments and any industry standard that did not support the retention of the existing 40 dB/decade extrapolation below 30 MHz – were all discounted by the FCC. The one IEEE BPL electromagnetic-compatibility (EMC) standard that *did* support what the FCC wanted to do, which was to allow the measurement of 4 data points near the BPL system to determine a “site specific” extrapolation, was readily embraced by the FCC, despite major technical flaws. This is inexplicable in the face of the fact that the IEEE EMC Society, the IEEE sponsorship with the most direct experience and knowledge of the subject area of the standard, rejected the standard and withdrew as a sponsor on technical grounds, *citing the very portion of the standard that the FCC adopted into rules as a major area that was technically flawed.*

ARRL placed into the record an *ex parte* paper that used several of the NTIA antenna models from the NTIA report and used NEC antenna modeling to predict the field strength at the points along the line that the FCC rules direct shall be measured. The NEC modeling showed that if one were to make measurements exactly as the FCC rules and proposed method would require, the calculated value of “extrapolation” varied wildly.

The FCC inexplicably justifies this variability as sufficient cause to make measurements of a mere 4 points away from overhead power lines, even though the modeling of antenna models uses to justify other parts of the rules shows that there *is* no “site-specific” value of extrapolation, as the results vary wildly at a particular site, from location along the line to location along the line, and by frequency. The ARRL and EMC Society were correct; the method is flawed and should not be used to determine extrapolation. Even the standard is crystal clear in this regard, stating: *This relationship is unique to a specific measurement frequency and location along the overhead line (see Figure A.1).*

The FCC is correct that the ability to make measurements of extrapolation exists in the present rules and that method can and does apply reasonably well to physically small radiators, but radiators that are large in terms of wavelength exhibit complex patterns of emissions, demonstrated strongly by ARRL filings placed into the record in this proceeding, with peaks, valleys and fields that do not decay gracefully with distance. In most cases, the pattern is skewed such that measurements made perpendicular to the radiating line are being made into and out of

peaks and nulls, giving results that are very unreliable. This was shown in ARRL's ex parte filings, yet the point was not discussed in any significant way in the 2nd Report and Order.

ARRL, however, does believe that the approach described in Std. 1775 could have some merit, but only if measurements are made along the line for each measurement distance from the line, and the maximum value at each distance from the line for each frequency is used for the calculation. Although this methodology is not perfect, it probably does represent the best that can be done in a very complex environment and it would yield reasonably acceptable results.

ARRL has placed into the record competent study after study and even international regulation that supports its positions, yet FCC dismisses these in favor of vague BPL-industry statements, which FCC simply accepts as fact because they support a politically determined outcome.

The FCC's positions can only be justified by its by proclaiming that the upper 20% of the noise made by BPL is "localized hot spots," and conveniently ignoring the maximum noise levels produced near BPL systems, when in reality, in the models used for the calculations, those so-called "hot spots" are not the results of some unusual conflux of out-of-the-ordinary factors, but come from simple models that represent the median way that power lines will radiate. The "hot spots" that occur with precise regularity in the standing wave pattern developed near a large radiator are the very essence of what the FCC is saying it is trying to determine by extrapolation – the way that a measurement of the maximum emissions at one distance corresponds to the maximum emission at another distance. This simply cannot be accomplished by basing a distance extrapolation factor that is based on finding the point of maximum emissions at a close distance, then using an extrapolation factor that is only accurate if the *actual* maximum emission at a greater distance is ignored by discarding the upper 20% of the data points from the wildly variable peaks and valleys that are seen in the standing wave patterns of field strength found near emitters whose dimensions are large in terms of wavelength.

One need look no farther than the language of the Part 15 rules that define extrapolation. Sec. 15.31(f)(2) describes the extrapolation of field strength versus distance for frequencies below 30 MHz, indicating that the method shall be used "pending the development of an appropriate measurement procedure for measurements below 30 MHz." It is clear that that the FCC intended that 40 dB/decade be a placeholder, not a final decision, yet in every instance since, the FCC has rejected any and all attempts to develop and "appropriate measurement procedure" unless it agrees with the FCC's decision to liberally allow the use of 40 dB/decade as an extrapolation factor. This is neither a scientifically appropriate or balanced way to foster the development of an appropriate procedure.

To ARRL's knowledge, Sec. 15.31(f)(2) of the FCC Part 15 rules, and the rules of a few other nations that typically adopt FCC rules to ensure good harmonization of regulation, is the *only* place where 40 dB/decade is applied as an extrapolation factor. In contrast to the FCC's oversimplified placeholder, in the numerous industry standards that ARRL described for the record in its ex parte filings a $\lambda/2\pi$ breakpoint is used to delineate the near and far field regions and extrapolation factors of 40 dB/decade are typically seen in these standards within the near-field boundary and 20 dB/decade are seen beyond the breakpoint. These standards represent the scientific basis on which a good extrapolation factor could be based, not a placeholder in the rules that is applied to only a handful of device types, not the much larger number of unintentional emitters regulated by other parts of Part 15.

One need look no farther than the existing BPL systems to know that the existing practice is wrong. ARRL has made measurements in a number of BPL systems and in the vast majority of these systems, the systems that are certificated under existing rules – and the existing extrapolation factors – are seen to be operating significantly above the FCC emissions limits. This excess is not a matter of a few dB in a few locations, which could be explained reasonably by site-to-site variations and hot spots. ARRL has seen BPL systems that are operating in practice as much as 25 dB above the FCC limits below 30 MHz, and as much as 40 dB over the limits above 30 MHz³. The rules and FCC test methods require that BPL systems be tested for certification at their maximum possible operating levels. According the certification test data, this was done, but when deployed, the systems are capable of and are actually operated at levels that are grossly exceeding the limits. This simply could not happen if the existing rules and practices were correct.

This problem of grossly exceeding the limits is not an old problem since resolved by the industry. In November 2011, ARRL made repeat measurements of the emissions levels in the BPL system operated by IBEC in and near Lovington, VA. ARRL found that most of the locations it had tested earlier were still operating grossly over the FCC limits.

ARRL also measured the BPL system in and near Mars Hill, NC, operated by the French Broad EMC. This system was also found to be operating at levels grossly exceeding the FCC emissions limits. The system also was not protecting the prohibited bands at all.

³ ARRL has filed formal complaints with the FCC about several BPL systems that exceed the emissions limits. The FCC has not acted on those complaints in over a year, thus preventing any meaningful examination of the "track record" of the use of 40 dB/decade in the present rules.

Summary

In looking at the totality of the existing rules and the unresolved problems with deployment in the field, the FCC attempts to justify the individual portions of the rules notwithstanding, it is clear that in total, the rules do not provide a good foundation on which BPL technology can be built. When deployed without notching of the amateur bands, interference has been seen in system after system, over a time span of eight years. Without universal notching of the amateur bands, there is no practical way to protect fixed, mobile and temporary portable amateur operation, which is ubiquitous. When certificated under the present rules, BPL systems as deployed grossly exceed the FCC emissions limits *in situ*.