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

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

To: The Commission

COMMENTS OF ARRL, THE NATIONAL ASSOCIATION FOR AMATEUR RADIO, IN RESPONSE TO "REQUEST FOR FURTHER COMMENT AND FURTHER NOTICE OF PROPOSED RULE MAKING"

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

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

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SUMMARY

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), submits its comments pursuant to the *Request for Further Comment and Further Notice of Proposed Rule Making,* FCC 09-60, 24 FCC Rcd. 9669, 74 Fed. Reg. 42631, released July 17, 2009 with respect to the reconsideration of the rules governing unlicensed radio frequency devices to accommodate Broadband over Power Line Systems (BPL).

The Commission has been given a third opportunity by the Court of Appeals to adopt, on remand, rules that which would, at once, (1) protect Amateur Radio communications from predictable and well-established harmful interference from BPL; and (2) permit BPL systems to operate in the 3 to 80 MHz range without significant constraint; without reduction in throughput or capacity; and without substantial redesign or retroactive build outs; in effect, as they are in practice operating today. Rule modifications can and should be adopted to incorporate the two parameters of which BPL modems are now capable: (1) mandatory, full time notching of all Amateur allocations by BPL systems; and (2) notch depths of 35 dB. These two requirements, together with a scientifically valid extrapolation standard for signal decay with distance from the power line, would be sufficient together to reduce the number of potential interference problems to a small enough number that it would be practical to address them on a case-by-case basis. They are achievable by present BPL technology without significant limitation on BPL deployment.

The recently released documents and materials affirm, and reveal graphically and aurally the absolutely preclusive interference caused by Access BPL over very large areas, when those systems operate under current rules. Access BPL is, absent substantial technical limits not found in the present BPL rules, absolutely incompatible with normal licensed Amateur radio communications. All of the 2003 and 2004 field studies concluded, consistently, that Access BPL has a significant harmful interference potential to normal residential Amateur Radio operation.

Based on the information available in the unredacted studies, and in the newly-released videos and study results that the Commission should have disclosed long before now, it can only be concluded that the full-time notching of Amateur allocations is more than amply justified by the ascertained interference potential of Access BPL systems to Amateur Radio stations, fixed and mobile, and that the notch depth should be a mandatory 35 dB. ARRL also requests the immediate deletion of 47 C.F.R. § 15.611(c)(1)(iii), which has been demonstrated herein and in the Commission's own engineering studies to be a completely inadequate and unreasonable limit on the normal, and otherwise absolute obligation of unlicensed device operators to protect licensed radio services from harmful interference (whether the victim receivers are in mobile or fixed configuration).

Furthermore, the Commission has failed to provide a reasoned justification for the retention of a 40 dB/decade distance extrapolation factor for signal decay with distance

from the power line. Since a reasoned justification for a 40 dB/decade extrapolation factor cannot be sustained in the face of the existing contrary evidence, the Commission should adopt another extrapolation factor that is consistent with the evidence. Its proposal of a 30 dB/decade extrapolation factor in lieu of the 40 dB/decade factor is arbitrary. ARRL, on the other hand, has justified in the past, and has again justified with these comments and the attached exhibits, 20 dB/decade as a scientifically justifiable extrapolation factor for frequencies below 30 MHz generally. While there is some increase in attenuation as the frequency decreases toward 3 MHz, the Commission's measurement techniques, and the variability in radiation from the power lines, necessitate the use of a 20 dB/decade extrapolation factor for the band 3-30 MHz for a physically large, line source radiator such as Access BPL.

If the Commission adopts a full time, 35 dB notching requirement for Amateur allocations between 3 and 54 MHz, and as well a scientifically valid extrapolation factor for signal decay with distance from the power lines, the Commission will have reduced the harmful interference potential of Access BPL to at least the Amateur Service to a reasonable level, and it will have at the same time accommodated Access BPL so that any potential it has in the future can be realized without unnecessary regulatory constraint.

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> *"Conclusion: BPL operating near the current FCC limits without specific means to reduce emissions in amateur bands will likely have a major impact on some amateurs. A 25-35 dB increase in noise floor 30 m from a residential power line is significant – especially if decay rate down the line is low."* [1]

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to the *Request for Further Comment and Further Notice of Proposed Rule Making,* FCC 09-60, 24 FCC Rcd. 9669, 74 Fed. Reg. 42631, released July 17, 2009 (the Further Notice), hereby respectfully submits its comments with respect to the Commission's reconsideration of the rules governing unlicensed radio frequency (RF) devices to accommodate Broadband over Power

[1] Steve Martin, Technical Research Branch, Federal Communications Commission (FCC) Laboratory; *Field Strength Measurements Relative to ARRL Concerns Regarding BPL,* October 16, 2003, PowerPoint® presentation, slide 12 (Listing considerations for BPL Notice of Proposed Rule Making With Respect to Amateur Radio). Released by the Commission *for the first time* on or after July 17, 2009.

Line (BPL) technology. For its comments, in the interest of the Amateur Radio Service in avoiding harmful interference from BPL systems, ARRL states as follows.

I. Introduction

This proceeding to date has been a disappointing example of the triumph of policy goals of a former administration over good-faith recognition of the technical necessities of spectrum management. In the process of affirmatively advocating [2] a technically problematic and arguably inferior technology in a directed effort to create a competitive broadband environment at any cost, the Commission has engaged throughout this proceeding in the unjustifiable withholding of valid, reliable technical evidence (including actual field tests and the conclusions therefrom, which were in the Commission's possession as early as 2003). This evidence contravenes the premises underlying the adoption of the BPL rules by the Commission in 2004 and affirmed in 2006. The evidence was and is in direct conflict with the Commission's affirmative conclusions about the interference potential of BPL to licensed radio services. In furtherance of the goals of the then-current administration to promote any and all broadband delivery mechanisms, regardless apparently of the consequences, the Commission hid from the public the results of its own staff studies, which exposed the interference potential.

In this case, the Commission had ample evidence that the adopted rules governing BPL operation were clearly insufficient to protect licensed radio services from predictable harmful interference. This evidence was developed well in advance of the 2004 Report and

[2] "Advocating" is far too mild a description of what happened in this proceeding. Former Commission Chairman Michael Powell publicly described himself as a "cheerleader" for BPL; an apt description of the zeal with which he, and the other Commissioners at the time promoted BPL, despite blatant examples of the substantial interference potential of BPL to licensed radio services in the Commission's possession. The Commission in this case ventured far beyond its proper role as a dispassionate regulator of the public's airwaves. Instead, it manipulated a rulemaking proceeding to achieve a predetermined outcome by advocating and promoting a spectrum polluter, and it is continuing to do so to the present time.

Order in this proceeding, comprising field tests conducted by its own competent engineering staff (including studies on which the Commission admittedly relied in later adopting its BPL rules). The Commission refused to allow those studies to be released to the public, however. Instead, it scuttled the adverse evidence and knowingly adopted the inadequate rules, drawing conclusions in the process (in an effort to justify those rules), which were and are directly at variance with the results of the studies. Having more recently been compelled by the United States Court of Appeals for the District of Columbia Circuit to reveal those studies and accept comment on them, the Commission is now obligated to utilize the received comments, and to re-examine ***all aspects*** of the BPL rules which have been drawn into question by the late disclosure of the heretofore redacted, or completely withheld documents.[3] What ARRL expects from this zero-based review of the BPL rules, as ARRL representatives made clear to the Office of Engineering and Technology in July of 2008, are revised rules with two principal components: (1) mandatory, full time "notching" of all Amateur allocations at all BPL deployments operating between 3 and 54 MHz with notch depths of at least 35 dB; and (2) a signal decay distance extrapolation factor that is consistent with valid, scientific evidence. It is submitted, based on the studies attached to these comments, that such a factor is neither 40 dB/decade of distance nor 30 dB/decade of distance, but a lower number for the band 3 to 30 MHz. [4]

[3] As will be shown, the Commission was ordered not only to disclose the unredacted versions of certain technical studies, but also to make them "available for notice and comment." It would be illogical for the Court of Appeals to require the Commission to seek comment on those studies unless its expectation was that the Commission would thereafter review the comments received, and to re-evaluate the 2004 BPL rules in light of what was revealed in the unredacted documents and the comments thereon. The required solicitation of comments on the withheld documents was, therefore, a curative process ordered by the Court. ARRL expects considerably more from the Commission in this process than a rubber-stamp affirmation of the existing BPL rules. As is shown herein, the facts necessitate substantial modification of the rules, which are presently woefully inadequate to protect licensed radio services from BPL interference.

[4] Exhibit D hereto shows how several widely accepted industry standards correctly address extrapolation. In these standards, magnetic field strength is shown to decay at a 40 dB/decade rate within a distance of

In addition to the withholding of adverse evidence in adopting the Access BPL rules, the Commission ignored evidence developed from other sources which *was* public, but which conflicted with the Commission's predetermined effort to permit Access BPL without any meaningful regulatory limits (however necessary those limits might be). That this was a concerted and deliberate effort was obvious from (among other things) the fact that the Commission's Enforcement Bureau took no action to resolve numerous, fully documented instances of harmful interference to Amateur Radio operations from BPL test and regular deployments. Such complaints were allowed to languish for long periods of time[5] without action or, in some cases, without any Commission investigation at the site of the BPL installation at all. To have acted on those complaints would have been tantamount to

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λ(wavelength) divided by 2π from a radiating source and a rate of 20 dB/decade beyond that distance. At a distance of 10 meters from a radiating source, above a frequency of 4.77 MHz, all points are beyond λ/2π so the field strength at that distance decays at a 20 dB/decade rate.

[5] Some complaints, such as those involving the BPL system at Briarcliff Manor, New York and at Manassas, Virginia, went unresolved for more than two years. The virtual abandonment of the Amateur Service by the Commission in enforcement in these cases was in stark contrast to the admonition of Commissioner Copps, who, in his 2006 Statement with respect to the Memorandum Opinion and Order in this proceeding, stated in part:

> Even as we seek to encourage BPL – as I stated when we issued our initial order two years ago – we must also insure that its providers protect existing spectrum users from interference. This applies with special force to amateur radio operators whose skills and dedication once again proved so valuable in the aftermath of Hurricane Katrina. Amateur Radio serves the public interest in so many ways that we must be always mindful of its needs. I believe today's Order strikes an acceptable balance (sic) between protecting existing users and providing BPL an environment conducive to innovation and to getting on with the job of deployment. But we should be ever alive to the reality that the unexpected often happens and unforeseen consequences are as often the rule as they are the exception. That's why 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.

With respect to BPL, what radio Amateurs deserved, they did not receive.

acknowledging the interference potential from BPL that the Commission strenuously and consistently sought to deny. So it simply ignored them. [6]

But for the remand of this docket proceeding to the Commission for further proceedings by the Court of Appeals, the ordered disclosure of unredacted staff studies of BPL systems and solicitation of comment thereon, and the obligation to revisit the assumed signal decay characteristics of Access BPL, the Commission's rules regarding BPL systems would not have been further examined. As it stands, those unredacted documents, and the additional documents and information (which had never before been identified, much less released by the Commission) released in July of this year at the same time as the Further Notice, necessitate a complete review of the proper regulatory framework for Access BPL systems. That review is provided in these comments.

Fortunately, this proceeding represents a *third opportunity* [7] for the Commission to advance Access BPL while minimizing the potential for harmful interference allowed by the present BPL rules. Since this proceeding was commenced, BPL technology has evolved substantially. Second generation Access BPL modems are typically *capable* of 35 dB of "notching" of certain bands in the High Frequency (HF) spectrum, which is more than 10 dB better than the first generation devices, without any significant loss of throughput. While present Commission rules do not require that Amateur allocations be

[6] Worse still, because there were very few BPL deployments, many of the interference complaints were from Amateur mobile stations rather than fixed stations. To eliminate those as a source of interference complaints, the Commission, in 2006, modified the BPL rules to create a special standard for mobile radio interference, effectively removing any reasonable opportunity for a radio Amateur to complain of harmful BPL interference. See, 47 C.F.R. § 15.611(c)(1)(iii).

[7] The Commission adopted the BPL rules in 2004, and affirmed them with changes that made the interference potential worse in 2006. It now has a third opportunity to adopt rules which accommodate BPL as an internet service delivery mechanism while reducing the interference potential to licensed services to a manageable level. Presently, as ARRL has established previously in this proceeding by reference to the technical work done by NTIA, the rules permit operation of BPL systems whose interference potential to Amateur high-frequency operation from Access BPL (unless no use is made of Amateur allocations), is essentially 100 percent at substantial distances from the power lines.

"notched," the second generation modems now deployed almost universally (in the few places where BPL is still under consideration as an internet service mechanism or otherwise) [8] are capable of such without any significant degradation of performance.[9] Rule modifications can and must be adopted now, while the docket proceeding is open on remand, so as to incorporate the two parameters of which the modems are now capable: (1) mandatory notching of all Amateur allocations by BPL systems at all times; and (2) notch depths of at least 35 dB. These two factors would be sufficient together to reduce the probability of harmful interference to the point that it would be practical to address harmful interference on a case-by-case basis. Those parameters are also achievable by present BPL technology without significant limitation on BPL deployment or performance. As to the extrapolation factor for signal decay, the Commission is urged to adopt a standard that is justified on a technical basis for BPL systems operating below 30 MHz, and determined using proper scientific methodology. ARRL has demonstrated in prior filings in this proceeding, and demonstrates again herein unequivocally, that the proper extrapolation figure is close to 20 db/decade of distance from the power line over most of the frequency range 3-30 MHz.

The Commission is urged in the strongest possible terms to finally acknowledge and address in a forthright manner the technical difficulties clearly associated with Access BPL systems, and to deal with them in rules that are successful in accommodating all concerned without the prejudgment that has clouded this proceeding since 2003. There

[8] BPL may not have enjoyed commercial success to date as a broadband delivery mechanism, but it is still under consideration for Smart Grid applications.

[9] At this time in the United States, BPL manufacturers have implemented notching of the Amateur bands in all of the installed systems, without significant adverse effect on the performance of those systems. ARRL technical staff has evaluated five different installations using generation 2 BPL technology with state-of-the art notch depth performance of 35 dB applied to Amateur band notching and found this to be a successful model to prevent widespread interference problems involving Amateur Radio. It should be the regulatory standard for all BPL systems.

have been two prior opportunities in this docket proceeding to do this; but in neither instance has the Commission addressed the BPL interference potential openly and directly, despite the strong and compelling findings of its own technical staff. The Court's remand constitutes a third, renewed opportunity to finally get it right. The continued denial by the Commission of the obvious and substantial interference potential of Access BPL has served neither the Amateur Service nor BPL advocates well. Certainly, the public has not benefited from it, because the number of BPL deployments, never significant, has now dwindled to a very few indeed.[10] There *are* responsible methods of regulating and deploying Access BPL between 3 and 80 MHz. But it is long past the time that the Commission's rules codified those responsible deployment methods and operating parameters for the benefit of all concerned.

II. Background

On October 28, 2004, the Commission released the 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). On or about February 27, 2005, ARRL and sixteen other entities timely filed petitions for reconsideration of the *Access BPL Order*. On August 3, 2006, the Commission adopted a Memorandum Opinion and Order, FCC 06-113, 21 FCC Rcd. 9308, released August 7, 2006 ("*Reconsideration Order*"), denying ARRL's petition and those of other petitioners for reconsideration, and modifying in some respects the

[10] The Commission cannot derive any satisfaction with its present BPL rules from a reduction in the number of interference complaints about BPL systems. The number of BPL deployments is exceptionally small, and the responsible remaining BPL companies do in fact notch Amateur allocations typically. That said, the technology is now under consideration in connection with Smart Grid systems, so the potential for incompatible, interference-causing Power Line Carrier systems persists, necessitating clear, reasonable regulations as suggested herein.

Access BPL Order. On October 10, 2006, ARRL timely filed a Petition for Review in the United States Court of Appeals for the District of Columbia Circuit, seeking review of both orders.[11] The Court heard oral argument on the Petition for Review October 23, 2007; issued its Opinion April 25, 2008, [12] and issued its mandate on June 13, 2008, remanding the Commission's BPL rules for further proceedings.[13]

Among several grounds for ARRL's court challenge to the Access BPL rules was the fact that, despite two different Freedom of Information Act requests filed by ARRL, the Commission had failed to disclose the entirety of five scientific studies on which the Commission admittedly relied in adopting the Access BPL rules. The Office of Engineering and Technology (OET) conducted these studies, which contained empirical data from Access BPL test sites at which BPL emissions were measured. The Court reviewed the unredacted versions of the studies *in camera* and determined that the redacted pages included "staff summaries of test data, scientific recommendations, and test analysis and conclusions regarding the methodology used in the studies." (*Slip Op.* at 15). The Court held that "…the challenged orders indicate that the five staff studies were never fully disclosed for comment even though they were, according to the Commission, a central source of data for its critical determinations" (*Slip Op.* at 17) and that the studies "consist of staff-prepared scientific data that the Commission's partial reliance made 'critical factual material'." (*Id.*) As well, the Court held that "[i]t would appear to

[11] Case No. 06-1343, Petition for Review of Orders of the Federal Communications Commission.
[12] *American Radio Relay League, Inc. v. FCC*, 524 F.3d 227 (D.C. Cir. 2008).
[13] The Court did not vacate the Access BPL rules (47 C.F.R. §§ 15.601-15.615 and other Part 15 rule sections modified in the Access BPL Report and Order) adopted by the Commission. Indeed, ARRL did not request such, because had that been done, Access BPL operation in the interim would have been subject only to the general Part 15 rules governing unlicensed devices. The Access BPL rules, though inadequate and insufficient to reduce the predictable interference potential to licensed services, were nevertheless slightly preferable to the general application of Part 15 rules to Access BPL systems in terms of interference prevention.

be a fairly obvious proposition that studies upon which an agency relies in promulgating a rule must be made available during the rulemaking in order to afford interested persons meaningful notice and an opportunity for comment….Where, as here, an agency's determination 'is based upon a complex mix of controversial and uncommented on data and calculations, there is no APA precedent allowing an agency to cherry-pick a study on which it has chosen to rely in part." (*Slip Op.* at 15).

Therefore, with respect to the redacted scientific studies of Access BPL, the Court ordered that "[o]n remand, the Commission shall make available for notice and comment the unredacted 'technical studies and data that it has employed in reaching [its] decisions, (citations omitted) …and shall make them part of the rulemaking record." (*Slip Op.* at 19). As is more fully discussed hereinbelow, the Court would not have issued a requirement that the public have an opportunity to comment on the unredacted version of the studies unless the Commission was also obligated to review those comments and in light thereof, to revisit the rules governing Access BPL that are drawn into question by the information wrongfully withheld from the public when the rules were adopted *ab initio*.

By March 31, 2009, almost a year later, the Commission had taken *no* action with respect to the disclosure of the unredacted scientific studies, and so had not solicited public comment on the unredacted studies. ARRL, therefore, filed with the Commission a Freedom of Information Act request [14] seeking the unredacted versions of the studies that the Court ordered be included in the rulemaking record, and about which an opportunity for comment was to be provided by the Commission. On April 28, 2009, the deadline for

[14] This was submitted with reference to the U.S. Attorney General's March 19, 2009 memo concerning FOIA requests. See, *http://www.usdoj.gov/ag/foia-memo-march2009.pdf*.

the Commission to respond to the FOIA request, OET responded with allegedly[15] unredacted versions of the five scientific studies and a cover letter dated April 28, 2009. The Commission's cover letter stated, with respect to the issues on remand, as follows:

> The Court's decision in the above-referenced case required the Commission to provide an opportunity for public comment on the unredacted versions of the report. The Court also remanded to the Commission for further justification of the extrapolation factor used for determining compliance with the Commission's standards for BPL systems (sic). The Commission will respond to the Court's direction separately.

On May 1, 2009, the Commission, *sub silentio*, posted the cover letter and the unredacted studies on its Electronic Comment Filing System in this Docket proceeding. It was not at the time accompanied by any public notice of that action, nor was there an opportunity for the public to comment on the unredacted studies.

The second basis for the Court's remand of the Access BPL Orders to the Commission for further proceedings was the Commission's decision to retain an extrapolation factor of 40 dB per decade as an assumption of the rate at which unintentional radiated emissions decay with distance from a power line carrying radio frequency Access BPL signals. The rate of decay of undesired radio frequency emissions at distances perpendicular to a power line determines the interference potential of those emissions to licensed radio services, and as well the power levels at which Access BPL systems may operate. The Court cited ARRL's argument that, to confirm its choice of a 40 dB per decade of distance factor (rather than a lower distance extrapolation factor which would have indicated a less rapid signal decay with distance from the power line), the Commission relied on modeling data using a method of measurement that is not based

[15] The release of the allegedly unredacted versions of the studies raises questions concerning certain anomalies in the dates and pagination of the documents, discussed below.

on empirical evidence derived from testing or scientific observation. The Court found that the Commission, "(a)lthough indicating that it was confronted with a 'lack of conclusive experimental data pending large scale Access BPL deployments'" nevertheless "provided no explanation of how this circumstance justified retaining for Access BPL an extrapolation factor that was designed to accommodate technologies different in scale, signal power and frequencies used." (*Slip Op.* at 21). Furthermore, though the Commission acknowledged that "the actual extrapolation factor can be determined empirically" for carrier current systems (*Slip Op.* at 22) it offered no reasoned explanation for its dismissal of empirical data that was submitted at its invitation. ARRL had submitted three studies published in 2005 by the Office of Communications in the United Kingdom (OFCOM), as well as additional analysis of its own, both of which demonstrated that an extrapolation factor of *20 dB per decade* is more appropriate for Access BPL. (*Id.*). However, on reconsideration, the Commission summarily dismissed the data, stating: "No new information has been submitted that would provide a convincing argument for modifying [the extrapolation factor or emission limit/distance standards] at this time." *Reconsideration Order,* 21 FCC Rcd. at 9318. The Court held that, given the acknowledged critical nature of the extrapolation factor, so conclusory a statement cannot substitute for a reasoned explanation, because it did not provide "assurance that the Commission considered the relevant factors nor a discernable path to which the Court may defer." (*Slip Op.* at 22).

Thus, the Court ordered that on remand, the Commission "shall either provide a

reasoned justification for retaining an extrapolation factor of 40 dB per decade for access BPL systems sufficient to indicate that it has grappled with the 2005 studies, or adopt another factor and provide a reasoned explanation for it." (*Slip Op.* at 23).

A full year after the Court of Appeals issued its Opinion and Mandate, the Commission had not complied with the Court's instruction, and would not indicate to ARRL when it might comply. ARRL had obtained, through its March 31, 2009 FOIA request, copies of the unredacted documents that the Court had ordered produced in April of 2008. But, by June 24, 2009, the Commission did not solicit public comment on those studies, nor did it justify its 40 dB per decade of distance extrapolation factor or propose a different one. Thus, on June 24, 2009 ARRL filed a *Petition for Writ of Mandamus to Compel Compliance with Mandate*, asking that the Court of Appeals order the Commission to fulfill its obligation imposed by the Court more than fourteen months earlier. The Court, on July 13, 2009, ordered that the Commission respond to this Petition by August 3, 2009. Rather than explain its delay to the Court, the Commission instead released the Further Notice in this proceeding late on July 17, 2009, anomalously affording the public only *thirty days* after publication of the Further Notice in the Federal Register to submit comments thereon.

The one-month comment deadline was anomalous not only because, by contrast, the Commission afforded itself *fifteen* months from the date of the Court of Appeals' Opinion to release the Further Notice. Of more interest was the fact that the Commission released, at approximately the same time as the Further Notice, more than 800 megabytes of *previously undisclosed and previously unidentified* material, including internal Commission staff reports prepared in part *by the same Commission staff engineer* who

prepared the five field studies that the Commission relied upon in part in adopting its Access BPL rules in 2004. These materials, prepared in 2003 and 2004, contain information which (a) should have been disclosed or at least identified in response to one or both of ARRL's FOIA requests filed with the Commission in 2003 and 2004; [16] and (b) directly controvert the conclusions that the Commission reached in the Access BPL Order and in the Order on Reconsideration.

Thus, the Commission has, since the Court of Appeals remand, released two groupings of documents and materials. One group was released directly pursuant to the Court's remand order (referred to herein as the "remand documents"), and the other ostensibly on the Commission's "own motion" (referred to herein as the "July, 2009 Documents." Each draws the entirety of the Commission's regulatory scheme for Access BPL into substantial question and reveals the necessity for additional restrictions on Access BPL systems to reduce the substantial harmful interference potential. Each compels a zero-based review of the BPL rules; and each requires a more substantial regulatory scheme for Access BPL than what the Commission has heretofore provided.

Finally, the Commission's attempt in the Further Notice to justify the 40 dB/decade extrapolation factor adopted in the Access BPL Order and affirmed in the Reconsideration Order is insufficient. It relies on calculations premised on flawed scientific methodology, and disregards empirical measurements, inexplicably elevating the credibility of the former above that of the latter. That the Commission is not

[16] See, Letter of Edmond J. Thomas, Chief, Office of Engineering and Technology, dated October 1, 2003, denying ARRL FOIA request for "any and all records of interference studies related to Broadband Over Power Line (BPL) systems…conducted…in the past two years…"; and Letter of Edmond J. Thomas dated January 4, 2005, regarding ARRL FOIA request for documents on which the Commission relied, in whole or in part, in the Report and Order, including field tests and the Commission's "own field measurements" (FOIA Control Number 2004-591).

convinced by its own argument is readily apparent by the fact that, following its attempted *ex post* justification of its use of the 40 dB/decade extrapolation factor, it immediately thereafter abandoned the argument and proposed instead to adopt an equally unjustified 30 dB/decade extrapolation factor in what appears to be the "King Solomon" approach rather than a real scientific analysis. What the Court of Appeals clearly called for on remand, if the Commission could not provide a reasoned justification for adopting a 40 dB/decade extrapolation factor, was for the Commission to "adopt another factor *and provide a reasoned explanation for it*." This, the Commission has not done. In fact, an appropriate extrapolation factor for Access BPL on medium voltage overhead power lines is, as will be shown below, close to *20 dB/decade of distance*. Furthermore, if actual measurements of *in situ* Access BPL installations are to be used in lieu of a reasoned extrapolation factor, the Commission's proposed method of allowing those to be conducted is flawed and unacceptable, based on an incomplete IEEE standard which is still under development, and which has not yet been published by the IEEE. In fact, the portion of the standard under consideration was the subject of a number of negative comments in the IEEE ballot process, which must yet be addressed by the IEEE's Working Group. It is unacceptable that the Commission arbitrarily discounted fully developed industry standards cited by ARRL its earlier filings in this proceeding, stating that the standard did not contain significant rationale for its conclusions, and instead here proposes to adopt a provision from a standard that is not yet complete nor final. The obvious motivation for this is that the established standard is not in agreement with the Commission's predisposition to ignore Access BPL's interference potential.

III. The Remand Documents

ARRL, at the time of the issuance of the BPL *Notice of Inquiry* in ET Docket 03-104, [17] filed its first FOIA request, seeking disclosure of documents that the Commission had in its possession constituting interference studies. The Commission identified three studies as being responsive, but withheld them as "preliminary" and based on "developmental testing methodologies." [18] The three studies identified were as follows:

(1) Measurement Data taken on Current Technologies Power Line Communications System at Test House in Potomac, Maryland;
(2) Emission Measurement data taken on Current Technologies Medium Voltage BPL System (22 April 2003); and
(3) Broadband Over Power Line (BPL) Measurements in Allentown, PA – Results of Radiated Emissions Tests Conducted (May 19-22, 2003).

No other field studies were identified in that "Vaughn Index" of materials not released pursuant to the FOIA request. The obligation of the Commission in response to an FOIA request is to itemize and index all documents that are responsive to the request but which are not being released, and to explain why they are not being released. [19] According to then-OET Chief Edmond Thomas, those three documents were not being released pursuant to Section 0.457 of the Commission's Rules (47 C.F.R. §0.457) because they were "interagency memoranda", "letters, including work papers", and "the result of testing methods that are still under development for evaluating the effects of BPL service for a current proceeding, are staff draft compilations, and reflect preliminary analysis only at this point."[20]

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[17] See, the Notice of Inquiry, *Carrier Current Systems, including Broadband Over Power Line Systems,* 18 FCC Rcd. 8498 (released April 28, 2003).
[18] Letter of Edmond J. Thomas, Chief, Office of Engineering and Technology, dated October 1, 2003, denying ARRL FOIA request. The content of these studies, we now find out, was not at all "preliminary"; it was summary findings constituting concluded work, in PowerPoint ® presentation form, from the Laboratory to Washington FCC staff.
[19] See, *Vaughn v. Rosen*, 484 F.2d 820, 826-28, *cert. denied*, 415 U.S. 977 (1974).
[20] *Id.*

It was a surprise, then, that the Commission, in the Access BPL Order, relied heavily on what were termed the Commission's "research," "investigations," "field tests," "field measurements," and "analyses" to support its conclusion that "BPL networks can generally be configured and managed to minimize and/or eliminate… harmful interference potential."[21] No results of such investigations, field tests, field measurements or analyses were included in the Docket file, nor even identified by the Commission in response to ARRL's FOIA request. Thus, ARRL asked in its *second* FOIA request, filed September 20, 2004, for records of any field tests or evaluations of interference potential from BPL systems. This FOIA request was later modified to seek those documents that constituted the Commission's "research", "investigations," "field tests," "field measurements," and "analyses" on which the Commission relied in adopting the Access BPL Order.[22] In response to that second FOIA request, the Commission, on or about December 22, 2004 released heavily redacted versions of five studies conducted by the Commission's Technical Research Branch of the FCC Laboratory, OET led by Steve Martin, an engineer in that Branch. *These five studies included the studies and materials identified but withheld by the Commission in response to the first ARRL FOIA request*:

> a) A presentation representing data collected during a field test of the Amperion and Main.Net BPL installations in Allentown, Pennsylvania (tests conducted May 19-22, 2003);
> b) A presentation representing data collected during a field test of the Current Technologies BPL installation in Potomac, Maryland (dated 22 April, 2003);

[21] Access BPL Order, ¶¶ 2, 23, 39.
[22] ARRL specifically asked for those documents on which the Commission relied which supported its statement at paragraph 2 of the Access BPL Order, that the "record and our investigations indicate that BPL network systems can generally be configured and managed to minimize and/or eliminate this harmful interference potential;" the statement at paragraph 23 that "based on extensive research, analyses and practical experience, we also continue to believe that the interference concerns of licensed users can be adequately addressed;" the reference in that paragraph to "field tests;" and the statement in Paragraph 39 that the NTIA Phase I field study "and [FCC's] own measurements" indicate that Access BPL systems are not efficient radiators, nor are their emissions "cumulative such that they permeate areas in which they are located."

c) A presentation representing data collected in a field investigation by FCC personnel of the BPL system in Briarcliff Manor, New York, which was the subject of an interference complaint (dated September 8, 2004).
d) A presentation representing data collected in a field investigation by FCC personnel of the Progress Energy BPL system near Raleigh, North Carolina, which has been the subject of an interference complaint (tests conducted June 28, July 2, 2004); and
e) A spreadsheet of data underlying items 1-4.

Items designated a), b) and portions of e) above were previously identified by the Commission in its "Vaughn Index" but not disclosed by the Commission in response to the first (2003) ARRL FOIA request.[23]

The Commission released on April 28, 2009, pursuant to ARRL's March 31, 2009 (third) FOIA request, and pursuant to the Court's remand order, the unredacted versions of the documents that it had previously released in substantially redacted form in December of 2004 pursuant to ARRL's second FOIA Request . However, the unredacted versions of these studies include numerous anomalies. It is not clear that the Commission has, to date, released the entirety of any of the studies listed above. In its response to ARRL's March 31, 2009 FOIA request seeking the unredacted versions of the above documents, OET Chief Julius Knapp's response letter includes the following curious disclaimer: "Note that certain slide numbers and dates appear to be out of sequence, due to repeat printing of files to generate unredacted versions of pages previously redacted." This is difficult to understand, in context. What is notable about these studies is that the slide numbers in certain instances are not merely out of sequence; there are also large gaps in slide numbers, indicating that there are numerous slides missing. With respect to the slide dealing with the BPL tests at Allentown, Pennsylvania, for example:

[23] Letter of Edmond J. Thomas, Chief, Office of Engineering and Technology, dated October 1, 2003, denying ARRL FOIA request.

1. Slide 1 (Title Page) is dated June 13, 2003 while the majority of the slides are dated December 22, 2004.
2. Slide 2 is dated December 22, 2004. The following slide, slide 3, is dated June 13, 2003. It contains an "ORIGINAL UNREDACTED" sticker.
3. Slides 4-16 are dated December 22, 2004. The following slide, slide 17, is dated June 20, 2003. It contains an "ORIGINAL UNREDACTED" sticker.
4. Slides 18-20 are dated December 22, 2004.

Slide(s)	Date
1 (Title Page)	6/13/2003
2	12/22/2004
3	6/20/2003
4-16	12/22/2004
17	6/20/2003
18-20	12/22/2004

With respect to the portion of that study dealing with Amperion, and starting again at page 1:

1. Slides 1-5 are dated 12/22/2004. Immediately after slide 5 are slides 26 and 27, both dated 6/20/2003. Both slides 26 and 27 contain "ORIGINAL UNREDACTED" stickers.
2. After slides labeled as 26 and 27, dates are again listed as 12/22/2004 and the slide numbering begins again at 8.
3. After slide 19, dated 12/22/2004, numbering is again disrupted by slide 40 dated 6/20/2003. Slide 40 does NOT contain an "ORIGINAL UNREDACTED" sticker.
4. After slide 40, dates are again listed as 12/22/2004 and the slide numbering begins again at 21.
5. After slide 27, dated 12/22/2004, numbering is again disrupted by slide 48 dated 6/20/2003. Slide 48 contains an "ORIGINAL UNREDACTED" sticker.
6. After slide 48, dates are again listed as 12/22/2004 and the slide numbering begins again at 29.
7. After slide 29, dated 12/22/2004, numbering is again disrupted by slide 50 dated 6/20/2003. Slide 50 contains an "ORIGINAL UNREDACTED" sticker.
8. After slide 50, dates are again listed as 12/22/2004 and the slide numbering begins again at 31.
9. After slide 31, dated 12/22/2004, numbering is again disrupted by slide 52 dated 6/20/2003. Slide 52 contains an "ORIGINAL UNREDACTED" sticker.

The slide dates clearly indicate that there exist at least two versions of these slides, if not three: one dated June 13, 2003, one dated June 20, 2003 and another dated December 22, 2004. Perhaps the latest version was created in order to create a redacted version of the slides, and the dates were simply updated by the computer that generated them. It is not

explained, however, whether or not there are other differences between the June, 2003 and December, 2004 versions of the slides. Nor are the gaps in pages explained. The unredacted (2003) version of the Amperion slides indicates that there were 52 slides, but there were only 32 produced by the Commission for this study. The problem is summarized in the following table:

Slide(s)	Date
1-5	12/22/2004
26-27	6/20/2003
8-19	12/22/2004
40	6/20/2003
21-27	12/22/2004
48	6/20/2003
29	12/22/2004
50	6/20/2003
31	12/22/2004
52	6/20/2003

There are similar problems with the other studies. With respect to the second study (Potomac, Maryland):

1. Slide 1 (Title Page) is dated 22 April 2003 while the majority of the slides are dated 12/22/2004.
2. Slides 2-34 are dated 12/22/2004. Immediately after slide 34 are slides 35 and 36, both dated 4/22/2003. Slides 35 and 36 contain "ORIGINAL UNREDACTED" stickers.

Slide(s)	Date
1 (Title Page)	4/22/2003
2-34	12/22/2004
35-36	4/22/2003

It is unclear whether there are any differences between the 2003 and 2004 versions of slides 2-34, since the April 22, 2003 versions of pages 2-34 of these slides were not produced.

Assuming for the moment that all of the slides, and the substance of all of the studies, as originally created by Engineers Steve Martin and Andy Leimer for the Commission's Technical Research Branch, OET have been produced in unredacted form, the studies reveal the following, which was not apparent from a review of the redacted documents initially released by the Commission in response to the ARRL second FOIA request:

(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. In fact, the Commission's measurements show that there is virtually no signal decay *along* the power line 230 meters from the coupler.[24]

(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 (20log R) than to the 40 dB/decade of distance adopted by the Commission at frequencies below 30 MHz.

(3) Access BPL has a considerably higher interference potential to licensed radio services than the Commission concluded in the Access BPL Order, if operated at the maximum radiated emission levels permitted by the Commission's Part 15 rules (and the BPL rules adopted in the Access BPL Order). Specifically, interference to licensed mobile radio receivers is very likely for very long distances along a power line. The studies also show that systems operating at the Part 15 emission limits will be at least 25-35 dB stronger than the median values of man-made noise at 30 meters distance. Extrapolating this to a mobile antenna closer to the lines results in a noise level even higher.

(4) The Commission erred in concluding that mobile Amateur stations would be protected from interference 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. That remedy falls far short of reducing BPL noise to the level of ambient noise in residential environments found by Commission's technical staff, and falls far short of

[24] This is an especially important point relative to the previously undisclosed 2003 conclusion of the Commission's Technical Research Branch, OET quoted at the outset of these comments, that *"… BPL operating near the current FCC limits without specific means to reduce emissions in amateur bands will likely have a major impact on some amateurs. A 25-35 dB increase in noise floor 30 m from a residential power line is significant – especially if decay rate down the line is low."* In fact, the Commission knew full well before the 2004 Access BPL Order that the decay rate down the line from the coupler is ***extremely*** low.

reducing BPL wideband noise levels to the point that mobile communications can be conducted in areas substantial distances from the power line. [25]

(5) The proper course of action for the Commission 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.

Attached hereto as ***Exhibit A*** are copies of certain of the redacted and unredacted pages of the studies released by the Commission. Notable among these is slide numbered 30 in the Allentown, PA test results. The slide, captioned "Conclusions Regarding Access BPL" was redacted in its entirety. It says in part that "[t]he tested overhead PLC devices do not (emphasis in original) act as point sources. – Emission from line shows virtually no decay 230 m from coupler…" The same conclusion was stated in slide numbered 3 of the Allentown field measurements, captioned "Major Conclusions." There, the Technical Research Branch of the FCC Laboratory repeated that "Overhead devices do **not** (emphasis in original) act as point sources (virtually no decay 230 m[eters] from coupler." Instead of simply accepting those results, however, the Commission dissembled in the Access BPL Order. Therein, at paragraph 39, the Commission stated:

> Although we agree with ARRL that Access BPL on overhead lines is not a traditional point-source emitter, we do not believe that Access BPL devices will cause the power lines to act as countless miles of transmission lines all radiating RF energy along their full length. First, the Part 15 emission limits for carrier current systems have proven very effective at controlling interference from such systems. Also, for the reasons indicated by PPL Telcom, we believe that the design and configuration of Access BPL systems will be inconsistent with the development of cumulative emissions effects for nearby receivers. Moreover, the NTIA Phase 1 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

[25] According to the reports, it is also far short of reducing BPL noise to the median values of man-made noise in residential environments, described in the IRU-R document P.372-8, "Radio noise."

> located. *Rather, we find that emissions from Access BPL systems tend to dissipate after a short distance from a coupler along a line, and then remain relatively the same for some distance.*
>
> Access BPL Order, at ¶ 39 (emphasis added)

The Commission had no basis for concluding that emissions from Access BPL systems "tend to dissipate after a short distance from a coupler along a line." Rather, the only information that it had on this subject, apparently, were the results of its own studies (on which it claimed it relied), which concluded precisely the opposite.

In the Field Measurement Study report dated September 8, 2004 (prepared more than a month prior to the adopted date of the Access BPL Order) concerning the BPL system at Briarcliff Manor, New York, [26] at Slide # 17, captioned "New Information Arguing for Caution on HF BPL," the Technical Research Branch reiterated its 2003 empirical finding that "Strong fields follow the power line for 0.5 mile. Not a point source." More importantly, however, the slide addressed an ongoing interference case brought to the Commission by ARINC. The Technical Research Branch concluded that, while that interference source was a PHONEX carrier current system that created an

[26] It is to be remembered that the Briarcliff Manor, NY BPL system was the subject of harmful interference complaints by radio amateurs over a two-year period of time, during which a member of the Commission's Enforcement Bureau staff personally witnessed the severe Amateur Radio interference, and yet no remedial action was taken by the Commission whatsoever. Among the materials released by the Commission on or about July 17, 2009 for the first time was video (Briarcliff Video #5) prepared by the Commission's staff which shows in a graphic, compelling manner the severe and constant interference caused by the BPL system in Amateur allocations over huge geographic areas which obviously precluded essentially all Amateur HF communications in the area. ***No objective observer of this video could possibly conclude that the level of BPL radiated emissions permitted by the Commission's Part 15 rules is acceptable.*** Despite having this information, the Commission nevertheless continued steadfastly to maintain afterward, in both the Access BPL Order and in the Order on Reconsideration that the interference potential of BPL is "low;" It based its BPL rules on that premise, which it knew or should have known was patently false. The video puts the lie to the Commission's statement at paragraph 39 of the Access BPL Order, that: "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." ***BPL interference most certainly does permeate areas in which the devices are located***, and the Commission knew that prior to authorizing it. Yet, it drew a contrary conclusion for political reasons.

interference area *extending at least five miles from the source*, Access BPL had a worse interference potential, because of several factors: In the PHONEX case, there were only two communications channels "overlapped" by the carrier current device, but with Access BPL, there could be anticipated to be approximately 1500 communications channels overlapped. Furthermore, the PHONEX carrier current system was based on building wiring extending a distance of perhaps 20 to 30 meters, while an Access BPL device would be mounted on overhead power lines extending for hundreds of meters. Notwithstanding this information (and with nothing to controvert this information that has been disclosed to date by the Commission), the Access BPL Order, a month later, held at paragraph 39, that " [a]long the line there also may be multiple points where emissions may be relatively higher but within the Part 15 limits (footnote omitted). However, because the signal level decreases significantly with distance perpendicular to the line, the potential for interference also decays rapidly with distance from the line." For this premise, the Commission cited "our own field measurements of Access BPL installations" and the NTIA Phase I Study.[27] The Commission's "own field measurements," therefore, established that the five-mile interference contour noted from a PHONEX carrier current system would be potentially considerably worse in BPL configuration due to the wide bandwidth and the extensive radiating elements of the

[27] The NTIA Phase I Study, *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, which contained extensive field measurement results, most certainly did *not* support the Commission's unsupported characterization that BPL signals decay "significantly with distance perpendicular to the line." Quite the contrary: what that study found specifically was that at current Part 15 levels, the interference contour of Access BPL systems to land vehicle, boat, and fixed stations receiving moderate to strong desired radio signals in the frequency range 1.7-80 MHz is likely in areas extending (perpendicular to the line) 30 meters, 55 meters and 230 meters respectively from the line. Where the desired signal strength is low to moderate (as is the case with Amateur HF communications), the interference contours extend, for the classes of receivers above, to distances of 75 meters, 100 meters and 460 meters respectively, from the power line. 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.

overhead power lines. Yet, the Commission concluded, citing those same studies, precisely the opposite with respect to the interference potential of BPL.[28]

In the same Briarcliff Manor report, Slide #19, captioned "HF Issues and Options" (which had been completely redacted in the version released in response to ARRL's second FOIA request) the FCC Laboratory listed several options for regulating BPL. The first was to ban BPL on High Frequency bands on overhead Medium Voltage power lines. This, the Laboratory concluded, "protects HF land mobile" stations from interference; it eliminates the risk of skywave interference from BPL radiated emissions, and it also eliminates interference between in-house BPL and Access BPL. A second option was to "impose [a] 5 dB height correction [factor]" and a *"20 log R extrapolation factor*." This, most notably, is the FCC Laboratory's recommendation that the Commission, if it is going to allow BPL on MV overhead power lines, should *use a 20 dB per decade extrapolation factor for signal decay with distance from the power line.* According to the FCC Laboratory, this "reduces interference [from BPL] to fixed stations."

Nevertheless, despite having this information from its own Laboratory based on field measurements made by Commission staff, the Commission in the Access BPL Order held as follows with respect to signal decay with distance:

[28] Lest there be any doubt about what the Commission claimed to have relied on in adopting its BPL rules, it stated, specifically, at paragraph 47 of the Order on Reconsideration, as follows: "We clarify that in this proceeding, the Commission relied, in the aggregate, on NTIA's BPL Phase 1 Report, on the various interference studies filed in the record, including ARRL's studies, and on its own internally conducted studies as described in the materials provided in the FOIA response to ARRL." To the extent that the Commission claimed comfort relative to BPL interference (notwithstanding having ignored completely the interference potential of BPL in the NTIA Phase I report and its own field studies) by virtue of having adopted "additional requirements for BPL systems over and above the Part 15 requirements for low-power unlicensed devices in these bands," that is specious; none of those "additional requirements" were even *applicable* to BPL interference to Amateur Radio stations.

> Despite the stated aversion of NTIA and ARRL to distance extrapolation, we recognize that at many *in situ* test locations, it may not be possible or practicable to measure at the proposed fixed distances of 10 and 3 meters. If a 10-meter distance places the measurement antenna on a roadway, safety may dictate increasing the distance to, *e.g.*, 14 meters in order to position the testers out of harm's way. Hence, we expect that distance extrapolation will be necessary for *in situ* testing. We note that NTIA's latest computer modeling results show that the variation of field strength with distance is consistent with the existing Part 15 distance extrapolation when used with the slant range distance to the power line as was proposed in Appendix C of the *Notice*. We also note that although the ARRL and ARINC recommend the use of a 20 dB per decade extrapolation factor rather than the existing 40 dB per decade in Part 15 for frequencies below 30 MHz, Ameren states that it has determined the characteristics of the fields near the line support the case for assuming a 40 dB per decade decay rate of the field away from the line and recommends the use of the existing 40 dB per decade extrapolation factor. Given the lack of conclusive experimental data pending large scale Access BPL deployments, we will continue the use of the existing Part 15 distance extrapolation factors in our rules, but with the slant range rather than horizontal distance. If new information becomes available that alternative emission limit/distance standards or extrapolation factors would be more appropriate, we will revisit this issue at another time.
>
> Access BPL Order, at ¶ 109 (citations omitted)

The Commission already had information that demonstrated that 20 dB/decade of distance was the proper extrapolation factor. It also had several industry standards that it ignored. Nevertheless, it adopted the inappropriate 40 dB/decade standard for the bands between 3 and 30 MHz so as to permit BPL systems to radiate at interference-causing levels. Moreover, it adopted this standard without any correction for the way field strength varies with height below 30 MHz. An appropriate correction should have necessitated, according to the FCC Laboratory (and ARRL's own showings), at least a 5 dB correction factor. No such correction factor was considered or adopted by the Commission below 30 MHz, however.

As to VHF, the same Briarcliff Manor, NY report, at Slide # 20 (titled "Low VHF Options") listed as an option (to protect licensed services from BPL interference) the

notching of low-VHF public safety channels, or requiring advance coordination for such facilities. Neither option was adopted by the Commission. Instead, a mere notification procedure was put in place. Notification does not constitute coordination, which envisions at least a cursory compatibility analysis. The same slide listed the 50-54 MHz Amateur allocation, and noted that Amateurs typically use that band for mobile operation as well as for fixed operation. Though the FCC Laboratory identified this as an issue, the Access BPL Order, and the Order on Reconsideration failed to even acknowledge the interference potential to Amateur mobile and fixed stations in the 50-54 MHz band and offered no remedy for it.

Perhaps most notable among the conclusions of the Commission's Laboratory with respect to BPL interference is revealed in Slide # 21 of the Briarcliff Manor study (captioned "BPL Spectrum Tradeoffs and Proposal"). Therein, the Laboratory engineers listed the interference potential for Mobile Radio (expressed as [I+N]/N, where I indicates Interference and N indicates ambient noise) in the 2-8 MHz range as "high" and at 8-30 MHz as "Very High." For fixed stations, based on actual measurements, the Laboratory found that the interference distance to fixed stations at 2-8 MHz was 62 meters, and at 8-30 MHz it was 400 meters for a single BPL device operating in an area with noise levels classified by ITU as "residential." The same chart showed the interference potential from BPL to mobile stations in the 30-50 MHz band as "moderately high" and that the interference distance from the line to fixed stations in the band as 54 meters. It specifically concluded that Amateur Radio operators were potential victims of interference in the entirety of the band 2-50 MHz. The Laboratory, as the result of these findings, essentially recommended strict limits on emissions from Access

BPL systems in the 2-30 MHz range, in order to protect Amateur, Federal HF Mobile, Public Safety HF mobile, and other mobile and international broadcast stations. These findings were strikingly similar to the interference contours noted by NTIA in its Phase I Study. The Commission never cited any authority that would indicate that the NTIA Phase I study conclusions nor those of its own Laboratory staff were incorrect about BPL interference distances. In stark contrast to the findings of its own technical staff and NTIA, it merely concluded that the interference potential of BPL was "low."

Despite this recommendation and these findings (listed accurately in fact but inappropriately from a technical and ethical standpoint by the FCC Laboratory as "spectrum tradeoffs"), the Commission chose in the Access BPL Order to trade off interference protection for licensed services from unlicensed devices [29] for shameless promotion of Access BPL as a possible competitive broadband delivery mechanism. The Access BPL Order stated at paragraph 23, in relevant part:

> Based on extensive research, analyses, and practical experience, we also continue to believe that the interference concerns of licensed radio users can be adequately addressed and that Access BPL systems will be able to operate successfully on an unlicensed, non-harmful interference basis under the Part 15 model. In this regard and as discussed below, we find that the harmful interference potential from Access BPL systems operating in compliance with the existing Part 15 emission limits for carrier current systems is low in connection with the additional rules we are adopting. From the information provided by our field tests, the tests conducted by NTIA, theoretical predictions by NTIA and ARRL, and experience of the several tests of Access BPL systems, we observe that the potential for any harmful interference is limited to areas within a short distance of the power lines used by this technology…In addition, the record provided in response to the *Inquiry* and the *Notice*, including the extensive studies conducted by NTIA, is more than sufficient to assure us that the rules we are adopting will adequately protect licensed services from harmful interference.

[29] An absolute obligation under the Commission's regulatory paradigm for RF devices and Section 301 of the Communications Act of 1934.

This statement includes fundamental inaccuracies. Neither the ARRL studies nor the NTIA Phase I study showed that harmful interference was limited to areas within a short distance of power lines. NTIA showed that interference distances were, with respect to fixed stations receiving low to moderate desired signals, hundreds of meters from the power line. ARRL's studies were consistent with those findings.

At paragraph 38 of the Access BPL Order, the Commission held that the existing Part 15 radiated emission limits were appropriate for Access BPL because:

> The effect of these limits will be to constrain the harmful interference potential of these systems to relatively short distances from the power lines that they occupy. In fact, in most cases the level of emissions from Access BPL systems will be at or close to the noise floor at distances beyond a hundred meters of an installed power line.

The radiated emission limits are not reasonable for Access BPL, in part because the interference potential at those levels to Amateur stations in residential areas is *considerably higher than the Commission acknowledged* in the Access BPL Order. As is shown below, the Commission's conclusion regarding the noise floor is simply wrong, and the Commission knew it when that conclusion was made.

With respect to the ambient noise levels in residential areas (which in part determines the appropriate radiated emission levels for Access BPL and as well the appropriate level of notching to protect mobile stations) [30] the Commission was well aware, in advance, of NTIA measurements (which were consistent with the FCC Laboratory measurements) showing that in ITU residential environments, the noise floor

[30] In the Order on Reconsideration, the Commission for the first time abandoned its longstanding requirement that unlicensed devices must protect licensed radio services against harmful interference. It held that, in the case of mobile interference from BPL, a BPL operator was not required to eliminate harmful interference, but instead only to reduce the operating power of the system in the area where the interference was to occur to a level 20 dB below the maximum radiated emission level for Part 15 devices generally.

was raised by BPL by *30 dB* at mid to upper ranges of the 2-30 MHz band. In the Access BPL Order, the Commission held that the most appropriate approach for ensuring that Access BPL systems are able to "mitigate" instances of interference to licensed services is to require that BPL systems incorporate the *capability* (which is not required by the rules to be used) to avoid using specific frequency bands. The rules require that Access BPL systems have the capability to remotely reduce power and adjust operating frequencies to avoid use of the same spectrum used by licensed services in certain areas. Techniques for doing this included adaptive, or "notch," filtering capability or complete avoidance of frequencies or bands of frequencies in specific areas. Notch filters were required to be capable of attenuating emissions to a level only *20 dB* below the applicable Part 15 limits in the case of frequencies below 30 MHz and to a level at least *10 dB* below the applicable Part 15 limits in the case of frequencies above 30 MHz. *The Commission specifically assumed that a 20 dB notch is sufficient to resolve any harmful interference that might occur to mobile operations, and in fact limited the obligation of BPL operators to address interference complaints by reduction of the power level of the BPL system in the area of interference complaints by only 20 dB below the Part 15 radiated emission maximum level.*

Yet, slide #13 of the Briarcliff Manor study, captioned "NTIA Results" (which had been completely redacted by the Commission when the study was disclosed pursuant to the second ARRL FOIA request) reveals that both NTIA and the Commission's field tests showed that in ITU residential areas, BPL increases the noise floor for land mobile stations at ranges up to 15 meters horizontal distance from the power line by ***30 dB*** in the mid-and upper ranges of the HF band. The chart attached to that slide shows that at

almost 100 percent of the points measured along a 340-meter BPL power line by the NTIA, the 20 dB (I+N)/N interference level was exceeded. Almost 60 percent of those points in the mid to upper HF range exceeded the 30 dB (I+N)/N interference level in a typical land mobile receiver. This is consistent, says the slide, with FCC Laboratory measurements. NTIA's measurements showed that ambient noise levels were *less than* those predicted for ITU Residential environments. Therefore, BPL increases ambient noise in environments in which Amateur stations are found by more than the levels outlined above. The slide quotes NTIA as follows: "The occasional sampling of environmental noise levels…with the BPL system turned off were lower than the levels predicted by ITU-R Recommendation P.372-8. Thus…use of the higher noise power levels predicted by ITU-Recommendation P.372-8 in our analyses may bias results toward *underestimation of interference levels*." (emphasis added) Viewed in the light of these findings by NTIA and the FCC Laboratory, the Commission's notching standard of 20 dB, and its conclusion that addressing mobile interference by a reduction of only 20 dB below the radiated emission maximum level permitted by the Part 15 rules generally is *insufficient* to resolve or preclude interference, and the Commission knew it when it adopted the rule. As to the adoption of the normal part 15 radiated emission limits for BPL systems, the Commission knew that level to be too high to avoid interference in the first place. At paragraph 38 of the Access BPL Order, the Commission held:

> We are not persuaded by the arguments of ARRL and others representing licensed spectrum users that the current emission limits are insufficient to limit the general interference potential of these systems. The 0 dBμV/m limit suggested by the ARRL is typically below the noise floor in the HF and low VHF bands and would be unnecessarily and prohibitively restrictive for Access BPL operators. [31]

[31] This statement is inaccurate. The 0 dBμV/m limit is not typically below the residential noise floor in the HF band, as the Commission's own Laboratory engineers found in 2003. See, *Field Strength Measurements*

In the Order on Reconsideration at paragraphs 29 and 30, the Commission attempted to justify the 20 dB notch depth:

> With respect to ARRL's request for an explanation of how we selected 20 dB as the level of attenuation that must be provided, we note that several factors were taken into consideration in reaching this decision. First, the Commission has long experience that unlicensed devices operating at the Part 15 limits generally do not cause harmful interference. In examining the performance of various Access BPL systems, our staff observed that if Access BPL emissions on frequencies below 30 MHz were reduced to 20 dB below the Part 15 limits, the potential for harmful interference to mobile HF reception in the vehicle used in their examinations would generally be limited to areas in close proximity of a BPL device or a power line carrying BPL signals except when signal margins are low… Upon review, we continue to find that the Commission's decision to assume that BPL emissions at or below the specified notching capabilities are sufficient to protect mobile operations is appropriate. The Part 15 radiated emission limit for Access BPL and other carrier current systems is 30 dBμV/m quasi-peak in a 9 kHz bandwidth at 30 meters for frequencies at or below 30 MHz (footnote omitted). When operating with a 20 dB notch below 30 MHz, the maximum allowed emissions from an Access BPL system is 10 dBμV/m at the Part 15 distance, which is at or only modestly above the noise floor in the HF bands. In another words, Access BPL emissions would not be significantly greater than the background noise at the distances normally used for protection against harmful interference from Part 15 unlicensed devices.

Actually, what the Commission's staff observed is quite different: the Laboratory staff found that the ambient noise levels were lower than the assumed standard for residential areas, and that the noise floor was increased in residential areas by 30 dB or more at HF. The Commission's "long experience" with Part 15 devices generally not causing harmful interference [32] is of course inapplicable in determining the proper reduction, since those

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relative to ARRL Concerns Regarding BPL, October 16, 2003, first disclosed by the Commission in July of 2009. If in fact the 0 dBμV/m limit is "prohibitively restrictive" for Access BPL operators, this points inescapably to the conclusion that there is a fundamental incompatibility between Access BPL and licensed Amateur Radio operation in the High Frequency and low VHF bands between 3 and 54 MHz, and that Access BPL should not have been authorized at HF and low VHF in the first place.

[32] It is unclear what this "long experience" consists of, relative to Part 15 interference complaints. The Commission does not routinely investigate residential interference complaints absent some safety issue, and interference from Part 15 devices is typically difficult to track down absent some technical skill. Therefore,

rules were developed for, and the Commission's experience was with, point source radiators, which Access BPL is most assuredly *not*. Therefore, the 20 dB standard was insufficient, and the Commission knew it long before adopting the 20 dB notch standard for mobile interference mitigation, but it adopted the 20 dB requirement anyway. It also assumed that "the noise floor at HF in all areas is highly variable on the basis of both time and location. Increases of 20 dB or more are quite common."[33] That assumption was based on nothing more than conjecture, apparently. The only applicable standard for ambient noise that was applied by the FCC Laboratory and NTIA for residential environments, where sensitive Amateur Radio receivers (fixed and mobile) are located, was revealed by NTIA and the FCC Laboratory to be overly liberal in fact. The 20 dB mobile interference notch standard, and the application of normal Part 15 radiated emission limits for Access BPL systems, are both shown to be inappropriate for Access BPL by the redacted studies alone.

There are other slides among the redacted studies that reveal in compelling fashion that the Commission simply covered up the bad news about BPL interference, and failed to enact rules which would predictably avoid harmful interference to, especially, Amateur Radio stations. These include, for example, Slide 16 of the Briarcliff Manor field measurements, which notes that skywave interference from Access BPL in the aggregate, without limits on deployment, could create within a year a significant increase in noise in the HF bands. What is revealed generally from the remand

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any conclusions about the adequacy of Part 15 regulations based on interference reports are suspect, to say the least.

[33] Order on Reconsideration, at ¶ 32. ARRL had submitted information in the record that showed that after a 20 dB reduction below the Part 15 maximum radiated emission level, the BPL noise measured midrange on a typical Amateur mobile HF receiver, which virtually precluded any Amateur HF mobile communications except the reception of the very strongest received signals. Any doubt about this would be resolved quickly by a review of the Commission's just-released Briarcliff Manor video #5, which graphically shows the interference of BPL systems *in situ* to mobile HF receivers.

documents, however, is that virtually all of the Commission's material conclusions about BPL, and the justification for its adopted BPL rules, conflicted with information that it had, and on which it claimed to have relied, well in advance of the Access BPL Order and the Order on Reconsideration. In the Order on Reconsideration, at paragraph 44, the Commission stated:

> The ARRL contends that the Commission had no record basis for certain of its assertions which underlie its conclusions. It specifically points to three statements in the Report and Order: "'The record and our investigations indicate that BPL network systems can generally be configured and managed to minimize and/or eliminate this harmful interference potential"'; "'[b]ased on extensive research, analysis and practical experience, we also continue to believe that the interference concerns of licensed radio users can be adequately addressed' [and] from the information provided by our 'field tests'… we observe that the potential for any harmful interference is limited …"; and "Moreover, the NTIA Phase I field 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.
>
> (citations omitted)

ARRL reiterates its earlier position, cited above by the Commission. Now, however, that the documents that the Commission relied on have been shown to contain additional material that directly and materially conflicts with the conclusions that the Commission reached in October of 2004 and affirmed in August of 2006, it is apparent that the entirety of the Commission's Access BPL rules lack technical integrity and must be revisited *in toto.*

IV. The July, 2009 Documents

Much more of a concern than even the Remand Documents is the fact that the Commission did not reveal before July 17, 2009 the existence of the additional

documents and materials that it finally has chosen to disclose to the public along with its Further Notice. These included video footage of BPL interference measurements (including the compelling video #5) of the harmful interference levels throughout the Briarcliff Manor BPL deployment area assembled by the Commission's Laboratory staff) but also including three additional PowerPoint ® presentations prepared by the same laboratory staff, within the same time period as the Remand Documents (and generally based on the same field measurements). Yet, the Commission, having identified and disclosed these documents *only now*, [34] seeks to minimize their effect by identifying them in the Further Notice at Paragraph 2 as "certain materials that contain preliminary staff research and educational information and were not previously available…" At paragraph 11 of the Further Notice, however, it is noted that the July, 2009 Documents were used in preparing the Remand Documents, on which the Commission claimed it relied in adopting the BPL rules. There is no doubt that the withholding of these additional documents, and the Commission's failure to even identify them at the same time that it released the Remand Documents in response to ARRL's second FOIA request was wrong, and continues to reflect a consistent pattern by the Commission of covering up adverse information about BPL interference potential. There is no way to substantially distinguish the three PowerPoint® presentations disclosed in July of 2009 from the redacted documents in terms of the Commission's obligation to identify and disclose them long before now.

The three additional PowerPoint® presentations prepared by the Technical Research Branch, FCC Laboratory, OET were as follows:

[34] The fact of the disclosure and the timing are a mystery. ARRL contends hereinabove that these three PowerPoint ® presentations are indistinguishable from the Remand Documents and should have been disclosed, or at least identified in response to either or both of ARRL's first or second FOIA requests.

1. “Field Strength Measurements Relative to ARRL Concerns Regarding BPL” dated October 16, 2003;

2. “Broadband Over Power Line (BPL) Test Results and Considerations” December 3, 2003; and

3. “BPL Emission Tests in Briarcliff Manor, NY” August 17-19, 2004.

These studies are most relevant to the determination of the actual interference potential of BPL to licensed radio services; the proper radiated emission level for BPL systems at HF; the proper distance extrapolation factor for signal decay; and the necessity of full-time notching of all Amateur Radio allocations by BPL systems in order to avoid interference.

The first study, *Field Strength Measurements relative to ARRL Concerns Regarding BPL*, concluded that the ITU Noise Models are overly liberal relative to ambient noise in residential areas, which in fact, according to NTIA, have decreased by 10 dB since the ITU noise models were adopted (measured at 137 MHz). The actual residential noise level is now (according to NTIA Report 02-390, December, 2001) 4 dB below the “rural” curve, per the graph in slide #3 of this study. Based on an assumed 30-meter distance from an Amateur antenna, BPL interference levels were analyzed by the FCC Laboratory, and the appropriateness of the 40 dB/decade extrapolation factor was evaluated. The FCC Laboratory was constrained by instrumentation noise, which restricts ambient noise level measurements to frequencies above 20 MHz. Notably, the FCC Laboratory correctly measured this noise at a representative height for Amateur Radio antennas (10 meters high, 30 meters from a power line). Using these parameters, the ambient noise in Amateur allocations above 20 MHz in a residential area was 5-8 dB below the ITU rural curve. The FCC Laboratory’s measurements showed that the BPL signals were consistently more than 20 dB above the business environment; more than 35

dB greater than the residential noise environment; and more than 40 dB higher than the rural environment. Slide 11 concluded that ***there would be a 28 dB increase in the noise floor caused by an Access BPL system operating 11 dB below the Part 15 radiated emission level, and that Amateur stations, operating (typically) near the ITU Galactic noise curve would be "swamped" by the BPL signal, assuming a representative Amateur antenna.*** [35]

The study noted appropriately that Amateur Radio operating in a residential area is not a robust system, as it is not configured to operate in near-worst case noise fields. Amateurs operate receivers at close to the local noise floor to maximize communications distance. Slide # 12 noted correctly that some radio Amateurs choose their residential location specifically because of low radio noise levels. On the other hand, BPL signal injection, in order to achieve throughput and range, must operate as close to the emission limits as possible. Though the Commission cited positive experience with the radiated emission levels of normal Part 15 devices relative to interference complaints, Slide 12 noted correctly that point source emitter Part 15 devices are typically operated indoors, and that, "[e]xcept for BPL, it is unlikely that an Amateur will be exposed to a Part 15 device near his property line that radiates at or near the Part 15 limits in an Amateur band. This study concluded that "***BPL operating near the current FCC limits without specific means to reduce emissions in amateur bands will likely have a major impact on***

[35] The Commission, in the Order on Reconsideration, however, concluded as follows: "When operating with a 20 dB notch below 30 MHz, the maximum allowed emissions from an Access BPL system is 10 dBμV/m at the Part 15 distance, which is at or only modestly above the noise floor in the HF bands." In other words, Access BPL emissions would not be significantly greater than the background noise at the distances normally used for protection against harmful interference from Part 15 unlicensed devices. Furthermore, the finding by the Commission's Laboratory staff shows that the increase in noise would be a total of 39 dB if the system was operating at the radiated emission limits permitted by the Commission's rules.

some amateurs. A 25-35 dB increase in noise floor 30m from a residential power line is significant – especially if decay rate down the line is low. [36] The FCC Laboratory recommended that the Commission "***should make power companies and BPL manufacturers aware of the high likelihood of interference.***" Instead of doing that, the Commission scuttled the entire report, and concluded that the risk of harmful interference to Amateur Radio was "low."

The December 3, 2003 report of the FCC Laboratory entitled "Broadband Over Power Line (BPL) Test Results and Considerations" repeated some of the slides and findings set forth in the "Field Strength Measurements relative to ARRL Concerns Regarding BPL" study. Slide #3 of the "Test Results and Considerations" study concluded, *inter alia,* that "BPL interferes with nearby shortwave & amateur reception (including MARS);"[37] that "resolving interference complaints will be difficult/impractical;" and that Part 15 radiated limits were "[a]dequate for most devices, but not for BPL." The difference, noted the Laboratory, is that BPL has a broad bandwidth; it has high emissions over that wide bandwidth; it is exempt from conducted limits except in the AM broadcast band; it is in close proximity to neighboring residential antennas; there are no intervening walls to attenuate interference; and the radiators have a large spatial extent. These differences were each noted by ARRL in its comments in this proceeding before the Access BPL Order, but the Commission claimed it believed otherwise. It did not acknowledge any of these factors at any time, much less distinguish or rebut them, nor did it have any information that drew its Laboratory's conclusions into question. Instead, it simply hid the study away.

[36] At Paragraph 38 of the Access BPL Order, the Commission concluded: "We do not see evidence that BPL operation will significantly contribute RF energy to generally raise the background noise level."
[37] MARS refers to the Military Affiliate Radio System.

At slide #17 of the study, the Laboratory explained why locating, identifying and resolving interference from BPL would be difficult or impractical (which in fact has proven to be the case in years of experience with BPL interference and Commission Enforcement Bureau inaction in such cases). It was noted that direction finding "won't work" with multiple, wide bandwidth, extended sources. Nor are temporary solutions available as options for licensed services, such as abandoning a channel.

Slide #19 concluded that the radiated emission level adopted by the Commission for BPL devices does not ensure protection against harmful interference to stations operating below 30 MHz at 30 meters distance with no walls. The graph on that slide shows that the permitted (Section 15.209) *radiated emission levels are far above the ITU residential ambient noise level*. The next slide concludes that substantial increases in the noise floor are possible under the Part 15 radiated limits. While the study concludes that Part 15 limits are effective for most devices, they are not for BPL. Harmful interference for normal point source radiators operating at the radiated emission limit under Part 15 is possible, but unlikely *unless* the interferer radiates at a high level within the narrow bandwidth of the victim receiver; the emission occurs at a time when the victim receiver is in use; the interferer is close enough to cause interference (even through intervening walls which attenuate the signal); the interferer is not under the victim's control (i.e. not on the victim's property); *and* if the victim cannot avoid the interference by changing channels. Conditions necessary for harmful interference are unlikely for most Part 15 devices, but are "likely to occur with BPL" (Slide #21).[38] A single BPL device overlaps

[38] Notwithstanding this accurate analysis, the Commission in the Access BPL Order nevertheless concluded, at paragraph 38, that: "[w]e continue to believe that it is appropriate to apply the existing Part 15 radiated emission limits to Access BPL systems. We are not persuaded by the arguments of ARRL and

many services, and the victim cannot avoid it by changing channel. Wide bandwidth and high signal levels for BPL are necessitated by the commercial goals of throughput and range. There is therefore every incentive to maintain high level emissions over a very broad span of spectrum. In fact, in ARRL's experience, *many of the BPL deployments tested by ARRL to date have been operating at levels in excess of the Part 15 radiated emission maximum in the HF band*.

Furthermore, the FCC Laboratory concluded that BPL radiators are inherently close to residential Amateur Radio antennas. The Laboratory concluded, using ARRL studies, that 53% of radio Amateurs responding to an ARRL survey [39] stated that their antennas were located within 30 meters of an overhead MV power line, and 31% reported that their antennas were within 15 meters of an overhead power line. Of course, none of these power lines are under the victim's control. Nor is there any intervening attenuation of the BPL signal before it reaches the outdoor Amateur Radio antenna, typically in the same horizontal plane as, or higher than, the power line. [40]

That BPL is an extended radiator was established by slide #28. The Laboratory concluded from studies that "Access BPL radiator may be 100's of meters long in some BPL implementations. Access BPL emissions from an overhead power line (below 30 MHz) showed no significant reduction 200 meters down-line from the injecting coupler." The Laboratory said that this characteristic may be true for all BPL systems.

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others representing licensed spectrum users that the current emission limits are insufficient to limit the general interference potential of these systems."

[39] http://www.arrl.org/survey.php3?pollnr=195

[40] The Commission had no answer for this problem. It simply said that radio Amateurs should move their residences in order to avoid BPL interference. At paragraph 38 of the Access BPL Order, the Commission said: "In addition, because power lines inherently can radiate significant noise emissions as noted by NTIA and ARRL, good engineering practice is to locate sensitive receiver antennas as far as practicable from power lines." "As far as practicable", for a majority of radio Amateurs who operate their stations from residences, is on the order of 15-30 meters from a power line, which has been shown by NTIA and FCC studies to be inadequate.

The study noted that the Homeplug standard for in-house BPL was designed to protect Amateur bands (by not using them), proving that BPL can be designed to comply.

In summary, the "Broadband Over Power Line (BPL) Test Results and Considerations" study concluded as follows:

(a) Radiated limits do not fully prevent interference from BPL, and that services operating close to the noise floor below 30 MHz are especially vulnerable.
(b) BPL significantly increases the likelihood of interference (relative to other Part 15 devices).
(c) BPL interferes with nearby shortwave and amateur reception, including Military Affiliate Radio Service. Locating, identifying and resolving interference will be difficult or impractical.
(d) However, BPL can be designed to protect specific bands.
(e) Even a small increase in noise level above a quiet rural local environment is perceived by an Amateur receiver as harmful interference (See Slide #42).

Each of these conclusions supported the *exclusion* of Amateur frequencies from those available for Access BPL operation below 30 MHz. However, the Commission continued to maintain that such was not necessary to protect Amateur Radio communications. Those conclusions must now be re-evaluated and the Commission's rules regarding BPL should be modified to reflect the actual interference potential of Access BPL to the Amateur Service. The required, full-time notching of Amateur allocations to a notch depth of 35 dB is the practical solution to these problems, and the state of BPL technology makes this a tolerable solution for BPL operators as well, without adverse effect on system throughput.

The third of the July, 2009 Documents is "BPL Emission Tests in Briarcliff Manor, NY" dated August 17-19, 2004. The stated purposes of the study were (1) to address a specific complaint by a licensed radio amateur in Briarcliff Manor, NY using a mobile radio in the 14 MHz band, and (2) to "provide data on BPL emission issues in

support of the FCC rulemaking process." It concluded that the "notches" on amateur radio bands were inadequate, and that in one case, a notched BPL device was "filled in" by noise from another BPL device operating 0.7 miles away. As to mobile interference, Slide # 19 of this study concludes that, in general, BPL audibility in a mobile receiver ended quickly when roads departed from the power lines, but the BPL sounds could be heard in a straight line distance up to 1.7 miles (2.7 kilometers) from the nearest in-band BPL device when power lines followed the road. Slide # 22 of that study shows that elevated signal levels from BPL were measured up to approximately 1.2 kilometers from the closest in-band BPL device. This shows that localized notching of Amateur bands is not effective in resolving interference *ex post facto*.

In the aggregate, these studies show that the Commission's assumptions in the Report and Order, with respect to the interference potential of BPL to the Amateur Service, both fixed and mobile stations, were wrong, and far from the mark. The Commission's Access BPL Order focused not on preventing interference from BPL to licensed services *ex ante*, but in mitigating interference to licensed services after the fact.[41] The Amateur Service is uniquely adversely affected by BPL interference, and the

[41] The Commission's reliance on *post hoc* remedies made no sense when adopted, and makes no sense now. The Access BPL Order and the Order on Reconsideration each relied heavily on what the Commission termed "mitigation techniques" and "operational restrictions" on BPL which it claimed benefited radio Amateurs. See, paragraph 48 of the Order on Reconsideration. At paragraph 50 of the Order on Reconsideration, the Commission stated that: "[a]s Current observes, the Commission based its rules on adequate data (sic) and its decision was reasonable in view of the safeguards provided by the required mitigation procedures. Amateur services, and all other radio services, except public safety and certain sensitive government operations which are afforded additional protection for reasons enumerated in the *Report and Order*, are protected equally by the mitigation techniques and other operational restrictions adopted in the BPL rules." At footnote 116 of the Order on Reconsideration, the Commission summarized these mitigation standards as follows: "The rules we put in place further subject Access BPL systems to additional limitations not required of any other unlicensed equipment: notching and frequency agility, consultation with licensed users, avoidance of operation in exclusion zones on certain excluded frequencies, Access BPL location identification in a public database, and an extensive method of measurement to determine compliance with our rules. Taken together, these provisions will minimize instances of harmful interference from Access BPL to authorized radio services. *See* 47 C.F.R. §15.615."

probability of harmful interference is virtually 100 percent in residential areas where there are overhead MV power lines. Practical experience with BPL interference indicates that the FCC Laboratory was absolutely correct: interference is not practically resolved *post hoc*, and BPL has a far higher likelihood of interference to the Amateur Service than do other Part 15 devices, which are qualitatively different. All of the foregoing information was in the Commission's hands well in advance of the Access BPL Order, and more than a year in advance of the Order on Reconsideration. Yet, the Commission scuttled all of it, due to its narrow focus on broadband rollout. The Amateur Service was treated unfairly in the creation of the completely inadequate rules governing Access BPL, and the rules must be revised in view of the facts just now coming to light, five years after those inadequate Access BPL rules were adopted.

What the above slides show in the aggregate is that radiated noise from overhead power lines carrying Access BPL increases significantly above the ambient noise level, measured at ground level. Based on the Commission's analyses, which ARRL suggests were made by Commission engineers with strong experience in measurement techniques and interference assessment, and which constituted accurate technical information, it must be concluded that the current BPL rules and test methods, when coupled with inappropriate distance extrapolation and measurement standards, simply do not protect

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Contrary to the Commission's statement, ***none*** of these "additional limitations" is helpful in the case of Amateur interference from BPL. The notching and frequency agility are not currently required to be implemented -- only the capability is required. Consultation with licensed users is not required in the case of Amateur Radio. Exclusion zones and excluded frequencies do not include any Amateur bands. Access BPL location identification in the public database is really just a bad joke. The database has ***never*** been accurate and it is not accurate now. In any case, it does not include and has never included all BPL deployments and it does not have to, according to the Commission, because experimental authorizations for BPL deployments are inexplicably exempt. Finally, the measurement techniques are technically flawed, ineffective and in any case not enforced whatsoever. As the FCC Laboratory found, interference resolution with BPL *post hoc* is both difficult and impractical. It has not worked. Interference prevention, *ex ante*, is the ***only*** option, and the present rules do not accomplish this whatsoever.

Amateur Service licensees from interference. The Commission, well-aware of the content of these presentations when it adopted the Access BPL Order, discounted ARRL's arguments independently making many of the same points.

V. The 40 dB/Decade Extrapolation Factor

The Further Notice, beginning at paragraph 25, attempts to justify its 2004 decision to adopt, and its 2006 decision to affirm, the use of a 40 dB/decade distance extrapolation factor for determining the decay of BPL radiated emissions with distance from the power line. To do this, the Commission:

(1) Refers to NTIA's June, 2004 comments claiming that the attenuation in field strength of emissions from BPL systems with distance from the power line is consistent with the existing distance extrapolation factors for unlicensed (i.e. point source) radiators generally "when used with the slant range to the power line."[42] These calculations were not based on any actual measurements, but only on (NEC) computer modeling.

(2) Claims that it had no "significant studies" that examined the "very large number of measurements that would be needed to address the different site characteristics that affect the attenuation of emissions below 30 MHz." The Commission thus discounts the Crieff and Winchester, Scotland OFCOM field measurements submitted by ARRL on the basis that the two studies (of three submitted) that tested BPL signal attenuation with distance [43] revealed somewhat conflicting results (nevertheless centered around 20 dB/decade rather than 40 dB/decade); did not necessarily reflect power line configuration in the United States; and in any case were too few in number to provide meaningful data. FCC concluded that the OFCOM studies, the NTIA Phase II report and the Brazilian report showed "variations around" 40 dB/decade, but the Commission did not indicate that any of those studies showed an extrapolation significantly greater than 40 dB/decade. "Around" in this case apparently means "lower" rather than "greater."

(3) Though disclaiming reliance on studies dated after the Access BPL Order and the Order on Reconsideration, the Commission nevertheless relies on the NTIA Phase II study[44] and a 2008 study from Brazil [45] that it claims supports 40 dB/decade. It is

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[42] See, the Further Notice at ¶ 26.
[43] Id., at ¶ 27; the two studies were the Winchester measurement study and the Crieff Amperion measurement study.
[44] *Potential Interference From Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7 – 80 MHz, Phase 2 Study*, *Volume I*, National Telecommunications and Information Administration (NTIA) Report 08-450, October 2007 ("*NTIA Phase 2 Study"*).
[45] Federal Republic of Brazil, *Radio Interference Tests from Broadband Power Line Communication Systems*, ITU Radio Communication Group WP-1A, Document 1A-32-E, June 9, 2008 (*Brazil Study*).

inconsistent that the Commission discounts the ARRL and OFCOM studies for the stated reasons, but relies heavily on a poorly documented Brazilian study as justification for reopening this issue, based on the Brazilian finding that fields decay at 40 dB/decade away from power lines. The Brazilian study represents measurements "along a single perpendicular path of a single system which may not be representative of power lines in the United States," which was precisely the Commission's stated reason for discounting the OFCOM studies. ***Exhibit B*** (attached hereto), entitled *Inadequacies in the Reporting of Test Results from the BPL System Measurements Made in Brazil*, authored by Ed Hare, ARRL Laboratory Manager and BPL expert, outlines serious discrepancies and omissions in this report, rendering it completely unreliable. These errors include the lack of any description of the test equipment used in the testing; the absence of any model number of the BPL equipment; the location of the testing; and a number of other necessary items routinely included in properly documented test reports.

(4) Disclaims ARRL's 2005 technical study and proposal for an alternative extrapolation submitted on an *ex parte* basis.

Looking at what the Commission had before it in 2004 and in 2006 at the times that it adopted and affirmed the 40 dB/decade standard, there was firm evidence in the Commission's possession that 40 dB/decade is <u>not</u> the correct extrapolation factor. The Commission had the September, 2004 Briarcliff Manor report from its Laboratory staff, which, at Slide #19 (cited hereinabove) concluded that the Commission should, if it intended to permit BPL on overhead MV power lines, adopt a height correction factor and a <u>*"20 log R extrapolation factor*</u>." Thus, the FCC Laboratory recommended that the Commission *use a 20 dB per decade extrapolation factor for signal decay with distance from the power line.* According to the FCC Laboratory, such "reduces interference [from BPL] to fixed stations." There is absolutely no reference to this FCC Laboratory recommendation anywhere in the Further Notice, or heretofore by the Commission whatsoever. Instead, the Commission attempts in the Further Notice to justify its decision for retaining the 40 dB/decade factor by citing studies that were not even in existence at the time of the Order on Reconsideration.

While the Crieff, Scotland measurement results were limited in scope, they, coupled with the Commission's own field studies which concluded that 20 dB/decade extrapolation was proper, were the *only studies based on measurements* that existed at the time. Each independently concluded that 20 dB/decade of distance was the proper extrapolation factor. ARRL also provided a number of modeled studies showing that 40 dB/decade is not the correct factor to apply below 30 MHz. ARRL's studies also showed that at angles upward from radiating power lines, field strength did increase with height and that the correlation between measurements made at 1 meter in height, 10 meters horizontally from an overhead power line, and the field strength at 30 meters distance, at upward angles where Amateur HF antennas are mostly likely to be located,[46] was very close to 20 dB/decade. While discounting any studies, measured or calculated, that did not support the Commission's position that field strength decays at 40 dB/decade, the Commission displayed great enthusiasm for claims that supported its political position. For example, the Commission departed from normal engineering practice and apparently relied only on the NTIA June 2004 comments (premised on NEC computer modeling) and the *incorrect* assumption that BPL signals (a line source) decay at the same rate as do emissions from point-source radiators. ARRL had established in the record that although the "near-field" region of a large emitter is related to wavelength and the size of the emitter, this is not the same reactive near-field region as defined by a point source. In this radiating near-field region, the field strength does not decay uniformly with distance; does not have a 377-ohm E to H field relationship; and the fields are not planar. These effects all occur because close to a large radiator, any particular point is not equidistant

[46] Good engineering practice and common sense both dictate that regulations, emissions limits and test procedures developed to limit the impact of unlicensed emitters on licensed services should be based on the expected locations of receivers and antenna systems that will be used by those licensed services.

from all parts of the source. For line emitters, the field strength follows a cylindrical Bessel function. Although the emissions from a long line emitter develop a standing wave in which the magnitude of the fields vary up and down with increasing distance, as shown in ARRL's filings, for a line emitter, the peaks or the average of these varying fields follows a 1/R or 20 dB/decade decay with distance.

The Commission seems to be arguing in the Further Notice that all that ARRL submitted into the record on the subject of the proper extrapolation factor was an *ex parte* paper in 2005, which the Commission attempts to discredit in the Further Notice. In fact, the record in this proceeding, especially during the reconsideration phase, is replete with arguments that the Commission disregarded on the subject. For example, in response to the arguments of several petitioners for reconsideration urging that the Commission retain the 40 dB/distance decade for measurements made below 30 MHz, ARRL made a comprehensive showing that the record in this proceeding did not (and still does not) support the use of 40 dB/distance decade for line emitters such as overhead power lines used for access BPL. To the contrary, ARRL's analyses show that line emitters do not decay at a 40 dB/decade rate between measurements made at approximately 10 meters distance from the line extrapolated to 30 meters distance. In addition to the technical material filed in the earlier parts of this Proceeding, in its Petition for Reconsideration, ARRL provided NEC-model analyses of the very models that the FCC stated that it used to make its determination that the 40 dB/decade test procedure did not need to be changed. These analyses showed that a number of different models of line emitters, fed differentially or longitudinally *in the fashion most commonly used in BPL systems* did not have a 40 dB/decade relationship between measurements made at 1-meter height along

the line and the point of maximum emission at 30 meters distance, especially upward from the power lines.

ARRL had argued consistently that it is illogical to conclude that, if a 20 dB/decade extrapolation is appropriate at 30.001 MHz, it somehow suddenly jumps to 40 dB/decade at 29.999 MHz. The sliding scale formula that ARRL had suggested in its Reconsideration Petition took into account the fact that some increase in the extrapolation factor was indeed seen in its analyses at 3.5 MHz, so some adjustment for a 20 dB/decade factor versus frequency decreases to 3 MHz is appropriate. This formula was based on the electromagnetic physics theory that demonstrates that in the reactive near field, defined by $\lambda/2\pi$, field strength decays at a 40 dB/decade rate. Although for line emitters, the cylindrical Bessel function is a more accurate (and less stringent) model, ARRL was willing to recognize that a higher extrapolation within the reactive near-field region could apply in some cases, so it was willing to cede that point as a compromise. But the arbitrary specification of 40 dB/decade from 3 to 30 MHz is not supported by electromagnetic physics or any accurate engineering in the proceeding to date. No party other than ARRL (save for the Commission's own laboratory engineers) provided any references to detailed actual measurements to the Commission.[47] More recent measurements of field strength with distance from in-premise BPL systems operating within buildings clearly show that in the upper half of the HF spectrum, magnetic field strength between 3 and 10 meters distance decays at a rate very close to 20 dB/decade. In the lower half of the HF spectrum, these data show that the decay is somewhat higher -- a

[47] The vague submissions by Ameren UE and Current Technologies were not measurements by any standard, yet the Commission gave them credence while discounting actual measurements by competent authority (OFCOM) because they supported the Commission's predisposition.

good match for ARRL's sliding-scale proposal or any similar extrapolation method based on 40 dB/decade within $\lambda/2\pi$.

Though the Commission claimed that its BPL rules, including the distance extrapolation factor, were determined with the intention of protecting incumbent licensed services against BPL interference, those in the proceeding that advocated a 40 dB/decade rate conceded that it would be applicable only where measurements were made along the ground. The radio services ostensibly to be protected, however, utilize antennas for HF communications at heights equal to or greater than the power lines, where the signal decay rate is far lower than at the measurement height of 1 meter. Few, if any, HF antennas are located at the 1-meter height specified in the Commission's recommended test method.

The NTIA 2004 comments purportedly relied on by the Commission provided significant analyses that showed that if a large number of BPL emitters are deployed, they will raise the worldwide levels of man-made noise. These analyses all presumed that the field strength of a BPL system is indeed 29.54 dBuV/m at 30 meters distance. The angles that will be propagated from overhead BPL lines are all upward from the line, not downward toward the ground. For the NTIA Phase I modeling of skywave propagation to have had any merit at all, the test methods used must have determined accurately the point of maximum emissions *above* the power lines. They did not. ARRL's analysis of the NTIA model showed that if a 40 dB/decade extrapolation is used, the test will not accurately reflect the actual maximum emissions from these systems.

ARRL continues to maintain that, based on the information before the Commission in 2004 and 2006, the proper conclusion to be drawn is that a 20 dB/decade

extrapolation should have been adopted and utilized for distance extrapolation for line emitters, which includes overhead lines used for access BPL.

The Further Notice continues the Commission's claim that the 40 dB/decade distance extrapolation factor was justified, even as the Commission now proposes in the same document to abandon it and to adopt instead a 30 dB/decade extrapolation factor below 30 MHz.[48] The ascertainment of a correct distance extrapolation factor (even if the rules are changed now, as ARRL insists, such that Amateur bands are notched to the -35 dB level on a mandatory basis, full time) is critical to the proper regulation of BPL deployments at HF.

Looking forward, ascertainment of the proper extrapolation factor is a less complex task than the Commission, and the NTIA Phase II Study, seem to assume. Again, it is illogical that, at 30.001 MHz, the Commission's rules provide that signals decay from a point at a rate of 20 dB/decade of distance, but, at 29.999 MHz, the BPL rules currently provide that signals decay at 40 dB/decade of distance. Succinctly, however, the reason that 40 dB/decade is an incorrect standard is basically as follows. The Commission's test method measures BPL emissions at ground level, using a loop antenna located one meter off the ground. A very basic principle of electronic engineering is that a low horizontal antenna (which is the *de facto* role of the overhead MV power line in a BPL configuration) radiates more energy upward than it does toward the horizon. A measurement made of a radiating power line at a height of 1 meter off the ground is not a good indicator of noise levels that will be present at angles upward from

[48] The Commission claims that it is re-evaluating the standard based on recently issued technical studies addressing the attenuation of BPL emissions with distance and efforts of the IEEE to develop BPL measurement standards. It has, the Further Notice contends, come to understand that there can be "considerable variability" in the attenuation of emissions from BPL systems across individual measurement sites that is not captured in the fixed 40 dB/decade standard.

that same power line, where HF Amateur antennas are typically located. The 40 dB/decade extrapolation factor and the lack of any correction for height, result in a BPL system which radiates at a level significantly in excess of the radiated emission limits, at the very point where most Amateur HF antennas are located.

The Commission's approach to measurement techniques of field strengths at HF is not appropriate for the environment. For example, the Commission, after concluding that there is "considerable variability" in radiated RF attenuation at BPL sites, ironically then proposes to permit compliance measurements to be done at only four points along the line. Measurement of only four points within that variability cannot determine the actual extrapolation. The simple fact is that any attempt to apply any measurement of extrapolation to such a complex environment is a recipe for inaccuracy, and thus for the "cherry picking" of results that is the inevitable result of the Commission's proposed revised measurement techniques. It would allow those doing the measurements to provide any value of extrapolation they want, in either direction.

Attached hereto as ***Exhibit C*** is a study prepared by ARRL Laboratory Manager Ed Hare, entitled "*Modeling as an Alternative to Measurements in Determining the Extrapolation of Measurements Below 30 MHz*." This study concludes (as does the Commission)[49] that the measurement of field strengths on frequencies below 30 MHz is complex, especially *in situ*. There are few standards that specify measurement methods below 30 MHz, and so good engineering practice dictates that the principles stipulated in

[49] At paragraph 23 of the Further Notice, the Commission states, in part: "We also recognize, however, that there can be considerable variability in the attenuation of emissions from BPL systems at individual measurement sites… To address this variability, we are requesting comment on whether we should adjust the extrapolation factor downward to 30 dB or some other fixed value and also specify and allow use of a special procedure for determining site-specific BPL extrapolation values using *in situ* measurements. The procedure for determining these site-specific extrapolation values would follow the general model under consideration in the IEEE P1775/D2 work.

standards that specify test methods above 30 MHz be applied to measurements below 30 MHz, scaled for frequency where such scaling is applicable. Most standards of measurement of emissions are limited to specifying methods for radiated emissions above 30 MHz because most regulations for emissions specify radiated emissions limits above 30 MHz and conducted emissions limits below 30 MHz.

The Exhibit C paper establishes that near-field measurements contain a high degree of variability, and that a few meters along the line will make a significant difference in the rate at which the signal strength decays perpendicular to the line, making any measurement unreliable in order to apply the extrapolation, even at ground level. There are even differences in signal decay at a maximum point of radiated emissions depending on which side of the power line is measured. A few degrees of difference in the angle estimated by the measurer that constitutes a 90 degree angle to the power line will make a significant difference in the measured result. A conclusion of this paper is that it is not possible to measure actual signal levels in the complex *in situ* environment surrounding power lines, unless a very large number of measurements can be made. Because of the practical limitations on this, due to restrictions on access to measurement points due to private property, terrain obstacles, etc. it is not possible to make a meaningful number of measurements. Four measurement points, as proposed by the Commission by citing this work-in-progress within an IEEE Working Group, will not yield an accurate, reliable or predictable extrapolation from any physically large radiator, such as BPL-carrying power lines.

The alternative, antenna modeling, is only as good as the parameters entered into it. In the real world environment, systems including power lines contain too many

variables to allow modeling to be used instead of measurements to determine *compliance*. It is, however, possible to use calculations to use models to determine the proper extrapolation factor by allowing modeling to do what measurements cannot (practically) -- view a large number of points to establish trends. Modeling can be used to show these trends for establishing test methods and extrapolation. The Commission's Rules specify that at frequencies above 30 MHz, extrapolation is done using a 20 dB/decade extrapolation factor, and below 30 MHz, the 40 dB/decade factor is used. The presumption is that above 30 MHz, measurements are made in the far-field region, while below 30 MHz, the measurements are made in the near field. The way that the fields vary in the reactive and radiating near field regions differ. In the *reactive* near field region, bounded by a distance of $\lambda/2\pi$, field strength decays at a 40 dB/decade rate. *However, in the radiating near-field region beyond that boundary, fields generally develop a standing-wave pattern that diminish with distance, but one that, on the whole, varies at a 20 dB/decade rate.* The inadequacy of the present BPL rules is due to the fact that the rules assume that all areas below 30 MHz are in the "near field" region without differentiating between reactive and radiating near field phenomena. The Commission's Rules treat all areas above 30 MHz as being in the far field.

The Exhibit C study concludes that at distances 10 meters from the radiating source, it is inappropriate to apply a 40 dB/decade extrapolation for any frequency above 4.78 MHz. A 40 dB/decade extrapolation beyond the reactive near-field region is flawed on its face, and at distances of 10 meters or more, all points are outside the reactive near-field boundary for all frequencies above 4.78 MHz. The Commission's rules presume that field strength changes rapidly with distance in the near field, which is correct only in the

reactive near-field region of the radiator. Modeling of physically small radiators shows that beyond the reactive near-field region, field strength decays at a 20 dB/decade rate. This is supported by measurements, such as the ones done for the Crieff study. For large-line radiators, the calculation is more complex, but it can be approximated by assumption of a line source radiator. For these radiators, within the region of $\lambda/2\pi$, the fields do not decay at 40 dB/decade as they do for physically small radiators, but generally decay up close at approximately 20 dB/decade. Beyond the reactive near-field region, the calculated field strength shows a standing wave, but the peaks of that standing wave, or the average of the fields of the standing wave, decay at a 20 dB/decade rate.

Finally, the Exhibit C study concludes that measurements at 1 meter in height are not reasonable as a means of determining interference potential to victim antennas often considerably higher than overhead power lines. Any extrapolation based on measurements at ground level must correlate well to emissions at upward angles if the limits specified are to offer any protection to those licensed stations. Because measurements at the heights necessary are typically impractical (though those heights were apparently used by the FCC Laboratory when conducting its own studies in 2003 at the Commission's Laboratory in Columbia, Maryland, based on the slides in the unredacted studies and the July, 2009 Documents), the 20 dB/decade standard is applicable: at the height of the radiator or at upward angles from the radiator, the fields decay at 20 dB/decade. At ground level, ground losses do increase the decay rate. But licensed services should *not* be protected against BPL interference *only* at ground level. The spectrum polluter must take the licensed service as it finds it, and not cause

interference. Accordingly, the extrapolation factor must take into account the normally encountered antenna height of the victim receiver.

VI. Industry Standards and Extrapolation Below 30 MHz

Attached hereto as ***Exhibit D*** is a paper by Ed Hare entitled *Industry Standards Addressing Distance Extrapolation*. This paper collects and analyzes the few industry standards for radiated emissions below 30 MHz. This paper notes that there are few such standards, because regulations for most unlicensed devices control conducted emissions below 30 MHz and radiated emissions above 30 MHz. However, those standards that do exist for radiated emissions below 30 MHz generally support measurement procedures that extrapolate measurements made at one distance to an estimate of field strength at a different distance. None of the standards analyzed in this paper, including an ANSI standard; two CISPR standards; and the Commission's Part 18 regulations (all of which include alternatives for distance extrapolation that apply below 30 MHz) apply a 40 dB/decade extrapolation factor below 30 MHz. With some minor variation in break points, all stipulate that electric fields or magnetic fields be extrapolated at 20 dB/decade, except in the reactive near-field region, nominally taken to be bounded by a distance of $\lambda/2\pi$ from the radiating source. FCC Part 15 stands alone in specifying a 40 dB/decade extrapolation below 30 MHz.

From this Exhibit D study, from the Exhibit C study, and from the Commission's Laboratory recommendations, it is apparent that any thorough analysis of the issue of the proper extrapolation factor would have revealed in 2004 and 2006 that the 40 dB/decade factor is completely inapplicable and woefully inadequate to protect licensed radio services from severe, preclusive and harmful interference from BPL in the HF band

between 3 and 30 MHz. The Commission, however, an unabashed and admitted advocate for BPL, was willing to sacrifice the integrity of the HF spectrum, a unique and renewable natural resource, in exchange for the unjustified promotion of an inferior and spectrum-polluting internet service delivery mechanism. It therefore covered up its own engineers' findings, and ignored all evidence contrary to its predetermination. It imposed no substantive restrictions whatsoever on this technology – even those necessary to prevent harmful interference. Now, the Commission is obligated to adopt a scientifically valid[50] extrapolation standard and modify its regulations with respect to BPL radiated emissions in the HF band. That scientifically valid extrapolation standard is in fact 20 dB/decade; not 30 dB, not 40 dB. The Commission is further obligated to preclude *in situ* measurements made using methodologies [51] that will inaccurately determine actual radiated emission levels from Access BPL on MV overhead lines.

VII. Other Issues

Not addressed in the Further Notice are other problems regarding Access BPL which undermine the regulatory framework for this technology (to the extent that there ever was any conceptual regulatory framework). The Access BPL database,[52] 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

[50] The Commission's 30 dB/decade proposed replacement standard is not such. The Commission admits, at Paragraph 37 of the Further Notice, that it is a completely arbitrary number: "We request comment on whether it would be desirable to modify the value of the BPL extrapolation factor to be 30 dB per decade or some other value. This lower value would apply a more conservative approach that would compensate for those cases where the actual attenuation is less than 40 dB. While we do not have statistics that indicate the distribution of cases where attenuation rate is less than 40 dB per decade, we believe that the additional margin provided by a 30 dB standard would encompass a large number of such cases…"

[51] Specifically, the Commission cannot permit *in situ* measurements at or near ground level, or at any level below the horizontal plane of the power line carrying BPL; and it cannot permit the measurements to be done at two, three or four locations along the line, for the reasons discussed in Exhibit C attached hereto.

[52] See, 47 C.F.R. § 15.615(a).

to omissions [53] and a lack of updated information. As but one recent example, in April of this year, ARRL sent an e-mail message to the contact person listed in the database for the Manassas BPL system. The e-mail contact listed in the database was invalid, and followup e-mail messages to the City of Manassas, Virginia went unanswered. There is thus no way to contact the operator of the Manassas BPL system, if in fact it is still operational. 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, as in the case of Manassas, e-mail sent to the contact point in the database comes back as failed mail. The database administrator is not properly maintaining the database, and never has.

VII. Summary and Conclusions

The Commission has been given a third opportunity by the Court of Appeals to adopt, on remand, rules that which would, at once, (1) protect Amateur Radio communications from predictable and well-established harmful interference from BPL; and (2) permit broadband over power line systems to operate in the 3 to 80 MHz range without significant constraint; without reduction in throughput or capacity; and without substantial redesign or retroactive build outs; in effect, as they are in practice operating today. This is because, since the 2004 rulemaking was commenced, BPL technology has evolved. Second generation BPL modems are typically capable of -35 dB of "notching", which is more than 10 dB better than the first generation. Commission rules do not

[53] The Office of Engineering and Technology, for example, has determined that Access BPL systems that were or are operating pursuant to Experimental Authorizations (rather than the Part 15 Access BPL rules) did *not* have to be included in the database. This is ludicrous, since the basic premise for the database was 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.

require that Amateur allocations be "notched" but the 2G modems are now deployed almost universally and can do so. In the United States, after considerable difficulty trying to resolve interference (or trying to avoid resolving interference), BPL manufacturers are universally, presently not using the Amateur bands in their deployments without significant degradation of the performance of their systems. This is a successful model, and new manufacturers and operators must be subject to the same standard. So, rule modifications can and should be adopted to incorporate the two parameters of which the modems are now capable: (1) mandatory, full time notching of all Amateur allocations by BPL systems; and (2) notch depths of 35 dB. These two requirements, together with a scientifically valid extrapolation standard for signal decay with distance from the power line, would be sufficient together to reduce the number of potential interference problems to a small enough number that it would be practical to address them on a case-by-case basis. They are achievable by present BPL technology without significant limitation on BPL deployment.

The Further Notice in this proceeding, however, is not encouraging. The Commission is apparently still asserting that its Access BPL rules were adequate when adopted for interference mitigation (relative to Amateur Radio) and that its 40 dB/decade distance extrapolation factor was justified and is in fact a valid standard. Those contentions are untrue and are quite obviously belied by the information that the Commission withheld from the public and which has only this year (more than a year after the Court ordered the Commission to produce it) come to light.

The Commission cannot contend that the documents and the compelling video (especially the Briarcliff Manor Video #5, which depicts graphically and aurally the

absolutely preclusive interference caused by Access BPL over very large areas, and which would cause any reasonable viewer to conclude that Access BPL is, absent substantial technical limits not found in the present BPL rules, absolutely incompatible with normal licensed Amateur radio communications) released in July of 2009 represent the views of a single Commission engineer. The fact is that all of the 2003 and 2004 field studies that resulted in both the Remand Studies and the July, 2009 Documents were prepared by the Commission's Laboratory staff. Those studies were conducted using scientifically valid methodologies. They concluded, consistently, that Access BPL has a significant harmful interference potential to normal residential Amateur Radio operation. One 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 Laboratory staff concluded that the interference levels would be typically at "25-35 dB."

Based on the information available in the unredacted studies, and in the newly-released videos and study results that the Commission should have disclosed long before now, it can only be concluded that the full-time notching of Amateur allocations is more than amply justified by the ascertained interference potential of Access BPL systems to Amateur Radio stations, fixed and mobile, and that the notch depth should be a mandatory 35 dB. Accordingly, ARRL also requests the immediate deletion of 47 C.F.R. § 15.611(c)(1)(iii), which has been demonstrated herein and in the Commission's own engineering studies to be a completely inadequate and unreasonable limit on the normal,

and otherwise absolute obligation of unlicensed device operators to protect licensed radio services from harmful interference (whether the victim receivers are in mobile or fixed configuration).

Furthermore, the Commission has failed to provide a reasoned justification for the retention of a 40 dB/decade distance extrapolation factor for signal decay with distance from the power line. Since a reasoned justification for a 40 dB/decade extrapolation factor cannot be sustained in the face of the existing contrary evidence, the Commission should adopt another extrapolation factor that is consistent with the evidence. Its proposal of a 30 dB/decade extrapolation factor in lieu of the 40 dB/decade factor is admittedly arbitrary. ARRL, on the other hand, has justified in the past, and has again justified with these comments and the attached exhibits, 20 dB/decade as a scientifically justifiable extrapolation factor for frequencies below 30 MHz generally. The only field measurements that the Commission had in the record in 2004 and 2006 are consistent with that standard. While there is some increase in attenuation as the frequency decreases toward 3 MHz, the Commission's measurement techniques, and the variability in radiation from the power lines, necessitate the use of a 20 dB/decade extrapolation factor for the band 3-30 MHz for a physically large, line source radiator such as Access BPL.

The Court of Appeals remand of this matter to the Commission, and the content of the heretofore withheld documents, necessitates a complete review of the BPL rules. Such a review, fairly conducted, would trigger a reduction in the permitted radiated emission levels for Access BPL, among other changes. However, if the Commission adopts the full time notching of Amateur allocations, and as well a scientifically valid extrapolation factor for signal decay with distance from the power lines, the Commission

will have reduced the harmful interference potential of Access BPL to at least the Amateur Service, and it will have at the same time accommodated Access BPL so that whatever potential it has in the future can be realized without unnecessary regulatory constraint.

Therefore, for all of the above reasons, ARRL, the national association for Amateur Radio, respectfully requests that the Commission amend 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

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