

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

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

**To: The Commission**

**REPLY OF ARRL, THE NATIONAL ASSOCIATION FOR AMATEUR RADIO  
TO OPPOSITIONS OF THE HOMEPLUG POWER ALLIANCE AND CURRENT  
GROUP, LLC TO PETITION FOR RECONSIDERATION**

ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated (ARRL), by counsel and pursuant to Section 1.429 of the Commission’s rules (47 C.F.R. §1.429), hereby submits its Reply to the *Opposition of the HomePlug Power Alliance* and to the *Opposition of Current Group, LLC to Petition for Reconsideration of Second Report and Order of ARRL, the National Association of Amateur Radio* (the “Oppositions”) filed on or about July 17, 2012. Therein, the HomePlug Power Alliance (HomePlug) and Current Group LLC (Current) each oppose portions of ARRL’s Petition for Reconsideration of the Second Report and Order<sup>1</sup> in this proceeding. HomePlug and Current, after claiming generally that ARRL has not raised any new “discussion or evidence” in

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<sup>1</sup> *Second Report and Order* (the 2<sup>nd</sup> R&O), FCC 11-160, released October 24, 2011, 76 Fed. Reg.71892 *et seq.*

this docket proceeding<sup>2</sup>, each principally attempt to justify retaining the 40 dB/decade of distance extrapolation factor for assumed signal decay of radiated BPL emissions from power lines. By way of brief reply to these arguments, ARRL states as follows:

1. Notwithstanding Current's overly (and unnecessarily) strident presentation of its argument, it should be noted at the outset that ARRL has no concern with the HomePlug industry initiative or with Current's product lines. HomePlug, very early on, recognizing the very substantial interference risk to the Amateur Radio Service, elected to not utilize Amateur allocations in BPL deployments. As the result, as HomePlug states at footnote 5 of its Opposition, "it mandates a notch in products certified by the Alliance to protect amateur bands in the 2-30 MHz range." Though Current's United States Access BPL deployments (at the time when the company was engaged in Access BPL deployments) also notched Amateur allocations,<sup>3</sup> not all Access BPL companies did so. Others, such as IBEC, claimed to have notched Amateur bands but either did not or stopped notching those bands. Where BPL

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<sup>2</sup> Even a cursory review of the ECFS will show that this contention is not true at all. ARRL has submitted a series of *ex parte* filings in this proceeding since the Court's remand of the case to the Commission. As but one example of the information contained in these *ex parte* filings, ARRL has submitted extensive analyses of international standards that are directly applicable to the notching requirement, notch depth, and the scientifically valid distance extrapolation factor applicable to BPL deployments. The Commission has ignored these, however in the 2<sup>nd</sup> R&O. If there is any repetition in ARRL's Petition for Reconsideration of the 2<sup>nd</sup> R&O, it is with respect to the data that the Commission has ignored in the 2<sup>nd</sup> R&O. The Commission is obligated to address the arguments made in the record, even if it disagrees with them. Current characterizes ARRL's legal arguments as "threadbare from overuse". It is entitled to its opinion. However, Current should note that the Commission was instructed by the Court of Appeals to take comments on the studies that it hid from the public and released only by virtue of the Court's order. It took those comments and, despite the record created thereby, merely restated its earlier, erroneous conclusions which led it to adopt the BPL rules which are completely ineffective to protect the Amateur Radio Service from interference. The Commission is not entitled to do that. It was, rather, obligated to provide a substantive analysis of the record created on remand. If ARRL's arguments with respect to that post-remand record are repetitive of pre-remand arguments, that is reflective only of the fact that the Commission, in the 2<sup>nd</sup> R&O, failed to address the record evidence. Instead it merely repeated its 2004 mantras that BPL is not a significant interference source; and that the BPL rules are adequate, without more, to protect the Amateur Service. Those arguments are untenable given the record in this proceeding.

<sup>3</sup> Current opposes mandatory notching at page 7 of its Opposition. Notably, however, it does not assert that BPL does not constitute - absent notching of Amateur bands - a significant interference potential to Amateur Radio. Nor does it assert that full-time, mandatory notching is in any way burdensome to BPL systems. It could hardly do so, given the fact that it was among the first to implement the (now industry standard) practice of notching Amateur allocations in its modems. Indeed, all that Current states is that the Commission has said "no" to notching, and ARRL has continued to urge the modification of the BPL rules to include this requirement, so the Commission should refuse again. That is not much of an argument, coming from Current.

deployments did not include notching to a reasonable notch depth, interference resulted.

Therefore, the Commission's BPL rules are inadequate to protect against interference because they do not require that which responsible entities such as HomePlug and Current already implement. The rules should change to mandate full-time, all-Amateur-band notching.<sup>4</sup>

2. If the Commission's rules mandated full-time, all-Amateur-band notching, the debate about the distance extrapolation factor would become largely academic.<sup>5</sup> As it is, however, the issue is still open. Current devotes the majority of its Opposition to its claim that 40 dB/decade is the proper extrapolation factor. It argues that the Commission need not establish that 40 dB/decade of distance is the only justifiable value, but only that 40 dB/decade is "within a zone of reasonableness," and that the 2<sup>nd</sup> R&O meets that burden. ARRL views this matter a bit differently. The Court of Appeals, among other things, remanded the extrapolation factor to the Commission with specific instructions to either justify the 40 dB/decade factor or adopt a new one and justify it. Notwithstanding the Commission's protestations that 40 dB/decade was justifiable, it clearly is not, and the 30 dB/decade proposal in the *Further Notice of Proposed Rule Making* in this proceeding was an unequivocal acknowledgement by the Commission of the inappropriateness of the 40 dB/decade factor. That said, ARRL agrees with Current that it is difficult to adopt a single extrapolation factor that is *scientifically based and technically valid*. Nor did ARRL insist on a 20 dB/decade factor, or any other number. ARRL has only asked for a scientifically valid number.

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<sup>4</sup> Current states that BPL interference complaints are "insubstantial and undocumented". The Commission's files show otherwise. What is "insubstantial" is the Commission's willingness to enforce the non-interference requirement in the Part 15 rules relative to BPL deployments. As to Current's note that there is at present only one interference complaint pending (the 1.5-year old complaint of interference to a fixed Amateur station from IBEC's unnotched BPL system in Afton, VA), that is correct. However, that is no indication that the interference problem is not substantial. It is only reflective of the present marketplace failure of Access BPL. What the future holds for BPL remains to be seen. If, as the Commission believes, it is a promising technology, it cannot realize that promise without rules that make it compatible with licensed, allocated radio services.

<sup>5</sup> ARRL's discussion of this issue in its Petition for Reconsideration was contained in one single paragraph. See, ¶ 20 of ARRL's Petition.

3. There is no good science supporting a 40 dB/decade extrapolation factor at distances in the region beyond wavelength/2Pi of distance from radiating BPL systems, and Current's analysis at pages 5-7 of its Opposition to the contrary is, as ARRL has already proven in the record, wrong. Rather, in that region, the accurate extrapolation factor is closer to 20 dB/decade. ARRL has previously, both prior and subsequent to the Court of Appeals' remand of this proceeding to the Commission, submitted extensive and definitive studies and analyses<sup>6</sup> clearly establishing that the correct extrapolation factor is close to 20 dB/decade in the region beyond wavelength/2Pi of distance from radiating BPL systems. The Commission had in its possession in 2004 and in 2006 at the times that it adopted and affirmed the 40 dB/decade standard, firm evidence that 40 dB/decade is not the correct extrapolation factor.<sup>7</sup> While ARRL accepts that the slant range method of measurement and a 40 dB/decade of distance extrapolation factor results in a horizontal measurement that is the equivalent of a 29.3 dB/decade factor, the point is that the 40 dB/decade extrapolation factor is not scientifically valid. Current argues the contrary based on an argument that ARRL already rebutted thoroughly.

4. Current continues to argue that BPL signals radiate significantly from only a few meters of line adjacent to the coupler. The Commission's 2<sup>nd</sup> R&O agrees with this, though it had earlier held that BPL was not a point source radiator. Further, the Commission's Technical Branch found that there was virtually no signal decay of a BPL signal 230 meters from a coupler

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<sup>6</sup> See, e.g. Hare, Ed, *Modeling as an Alternative to Measurements in Determining the Extrapolation of Measurements Below 30 MHz*, Exhibit C to ARRL's Comments in this proceeding filed September 23, 2009; Hare, Ed, *Industry Standards Addressing Distance Extrapolation*, Exhibit D to ARRL's Comments in this proceeding filed September 23, 2009; and Hare, Ed, *Rationale for the Abandonment of the Use of a Single 40 dB/decade Extrapolation Factor for Radiated Emissions Measurements Made Below 30 MHz*, Exhibit A to ARRL's written *ex parte* submission in this proceeding filed January 11, 2010.

<sup>7</sup> The September, 2004 Briarcliff Manor report prepared by its own Laboratory staff concluded that the Commission should, if it intended to permit BPL on overhead MV power lines, adopt a height correction factor (accounting for the use of slant range measurements) and a "*20 log R extrapolation factor*." 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."

along the power line. *No test results have been released by the Commission showing otherwise.*

Current hypothesizes that in the event ARRL (sic) is correct, and that BPL radiates as a line source rather than as a point source, there is a fast drop-off in the near field. So, if 20 dB/decade were the correct parameter in the far field (Current concedes that 20 dB/decade is consistent with a very long line-source emitter in the far field) measurements in the near field would show a much steeper attenuation, at least 40 dB/decade. Therefore, it argues that an appropriate attenuation factor would be at least 40 dB/decade.<sup>8</sup> Current apparently believes that the near field is defined solely by the dimensions of the antenna. In fact, however, it is the *reactive* near field, bounded by  $\lambda/2\pi$ , where the fields decay rapidly. In the “radiating near field”, fields vary less rapidly overall, but develop standing waves that decay up and down with distance. The average power in this standing wave decays at 20 dB/decade. ARRL’s filings in response to the Further Notice in this proceeding explain this, and there are other sources as well: See:

<http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf08511.html#gl-2.2.2> .

The fundamental assumption of Current in this respect is flawed, and its conclusion that 40 dB/decade is the proper extrapolation factor is flawed.

5. Current continues to assume that BPL radiates as a point source. It says, in that case, that “[t]he near field would then be small, and measurements made at a distance of 30 meters would take place in the far field,” which it says is (again) 40 dB/decade. This is completely, and

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<sup>8</sup> Current asserts two scientifically incorrect premises. First, it implies that in “the near field,” signals decay at 40 dB/decade, so anywhere within the near-field region of a large radiator, fields decay rapidly. This is incorrect. Current fails to appreciate the distinction between the reactive near-field region bounded by the wavelength divided by  $2\pi$  and the radiating near-field region bounded by the size of the radiator, typically assumed to be two times the maximum dimension of the radiator squared divided by the wavelength. Within the reactive near-field region, fields generally decay at 40 dB/decade to 60 dB/decade. In the radiating-near-field region, the radiated energy develops a complex pattern, seen in a number of the graphs in the NTIA studies and other studies in the record. This is the “variability in propagation” that HomePlug discusses. Fields do not uniformly decay at any rate within this region. This technical inaccuracy and oversimplification offers no justification for the retention of 40 dB/decade as an extrapolation factor. Current makes the further unsupportable claim that field strength decays at 40 dB/decade in the far field from “point sources.” This is indisputably incorrect. In the far-field region of *any* emitter, fields decay at 20 dB/decade in free space.

rather obviously, in error. For a point source or physically small radiator, there is only a reactive near-field region, which is bounded by  $\lambda/2\pi$ . Within that region, fields decay at approximately  $1/D^2$ , or 40 dB/decade. Beyond that distance, fields decay at  $1/D$  or 20 dB/decade. For a non-point source, within  $\lambda/2\pi$ , fields decay at no more than 40 dB/decade, and for the magnetic field, for an infinite line emitter, they decay at 20 dB/decade right up to the source. Real emitters are somewhere between those extremes. Beyond  $\lambda/2\pi$ , fields decay up and down, out to a distance bounded by approximately  $2D^2/\text{wavelength}$ , where  $D$  is the maximum size of the radiator. It is wrong to assume, as Current does, that there is only one “near field” and that it is defined only by the size of the emitter. Current’s assertion, drawn from that assumption, that fields decay at 40 dB/decade at any distance from a point source is a glaring error. Concisely restated, outside the  $\lambda/2\pi$  region, theoretical considerations, industry standards and practical testing show that field strength varies at 20 dB/decade, on the whole, with standing waves.

6. Current also contends that the extrapolation factor of 40 dB/decade at frequencies below 30 MHz has been part of the rules “for decades”. That is precisely why an unbiased evaluation of this factor is overdue. The Commission’s own rules state that 40 dB/decade would be used below 30 MHz “pending the development of an appropriate measurement procedure for measurements performed below 30 MHz.” The number of radiated emissions measurements below 30 MHz has been relatively small, and most of those have been well below 1 MHz. At frequencies below 1.59 MHz, both 10 and 30 meters are within  $\lambda/2\pi$ , so 40 dB/decade would be correct. Relying on the tenure of this extrapolation factor for its justification is precisely backward, given that the Section 15.31(f)(2) rule describes the 40 dB/decade factor as a placeholder pending the development of a technically correct standard.

7. Lacking any cognizable defense for the hopelessly inaccurate and incomplete BPL database that UTC is supposed to be maintaining but hasn't<sup>9</sup>, Current merely states that it is "not at issue" in this proceeding and that ARRL's "complaints" about it are "out of place" on reconsideration. Current is again wrong. The database is very much at issue on reconsideration for two reasons: First, the Commission relies on it in the 2<sup>nd</sup> R&O in order to significantly overstate the number of BPL deployments, thus leading it to significantly *understate* the relative number of instances of interference. Second, in lieu of, and to avoid adopting any effective interference prevention mechanism, the Commission reaffirmed the adequacy of its ineffective, *post hoc* interference remedial scheme, which has as a cornerstone the availability of the BPL database. At Paragraph 55 of the 2<sup>nd</sup> R&O, the Commission said:

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

Because the BPL operator has no incentive to utilize the notching capability unless it is required by the Commission to do so; because experience, including recent experience, shows that they simply don't notch all Amateur bands, even when confronted with an interference complaint; because the Commission has made clear by its inaction in interference cases that go on for *years* that it has no intention to conduct any enforcement where interference complaints relate to BPL;<sup>10</sup> and because reliance on the BPL database called for by Section 15.615(a) of the rules for

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<sup>9</sup> Notably, the Opposition to the ARRL Petition for Reconsideration filed by Edison Electric Institute and the Utilities Telecom Council is silent on the issue of the adequacy of the database.

<sup>10</sup> This is true as well with general power line interference cases. Dozens of these cases, in which power line noise completely precludes Amateur Radio communications, have persisted without Commission resolution for up to 12 years in some cases. Unresolved power line interference cases three or four years old are the norm.

anything at all is impossible, ARRL continues to call for at least one, non-burdensome, effective interference prevention requirement. Nothing in the present BPL rules contributes at all to interference avoidance. Because the Commission touts the database as one of the major means by which the current rules “adequately” address BPL interference potential (in lieu of mandating full-time notching of Amateur bands), it is certainly reasonable on reconsideration to draw into question the adequacy of the database on which the Commission, amazingly, continues to rely.

8. It is a mystery, however, why Current (and, *sub silentio*, HomePlug, which claims to endorse the arguments of EEI and UTC) takes the position it has with respect to a regulatory requirement for full-time notching of Amateur bands. Current’s products have done that for years, and the HomePlug standard is fully consistent with the requirement as well, as discussed above. There can be no argument but that full-time notching of Amateur bands can be done without any adverse effect on BPL systems. Such a requirement would obviate any further debate about the appropriate signal decay extrapolation factor and it would, even at a required notch depth of 25 dB rather than a more normal industry standard, prevent the majority of interference cases from arising. Amateur Radio is, in residential areas (as the Commission, in the quote above, has admitted) in a uniquely vulnerable position. Yet, Current and Homeplug oppose the addition of one, non-burdensome requirement in the rules that would allow the Amateur Service some modicum of protection from BPL interference and to allow what the Commission continues to refer to as an “important new technology” to proceed in the marketplace without the stigma of the spectrum polluter that it otherwise clearly is. That the Commission wants to stay the course on this issue is not surprising; why Current and HomePlug take the position that they do is, however, puzzling. Full-time, mandatory notching of Amateur bands is, as ARRL has asserted repeatedly before, a win-win situation for all concerned. The denial of the substantial

interference potential of BPL and the argument that the present BPL rules address the interference potential adequately are untenable. Those arguments, and the continued, unnecessary debate about the extent of signal decay at distance from unshielded power lines radiating high-frequency radio signals need not continue through further appeals. The matter should be resolved now.

Therefore, for all of the above reasons, ARRL, the national association for Amateur Radio, again respectfully requests that the Commission reconsider and modify the rules governing Access Broadband over Power Line systems in accordance with ARRL's Petition for Reconsideration.

Respectfully submitted,

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

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July 27, 2012

**CERTIFICATE OF SERVICE**

I, Christopher D. Imlay, do hereby certify that I caused to be served, via electronic mail a copy of the foregoing **REPLY OF ARRL, THE NATIONAL ASSOCIATION FOR AMATEUR RADIO TO OPPOSITIONS OF THE HOMEPLUG POWER ALLIANCE AND CURRENT GROUP, LLC TO PETITION FOR RECONSIDERATION** to the following, this 27<sup>th</sup> day of July, 2012:

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