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February 5, 2004

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12th Street SW  
Washington DC 20554

**Re: ET Docket No. 03-104, *Broadband over Power Line Systems*  
Ex Parte Communication**

Dear Ms. Dortch:

Pursuant to Section 1.1206(a)(1) of the Commission's Rules, on behalf of Current Technologies, LLC, I am electronically filing this written ex parte communication in the above-referenced proceeding regarding broadband over power lines ("BPL").<sup>1</sup>

Current Technologies has carefully designed and tested its equipment to minimize any potential for causing harmful interference to licensed users in the bands in which its equipment operates, and specifically by complying with applicable Part 15 technical rules.

Current submits this filing to further clarify and add to the record on BPL's compatibility with licensed operations. We emphasize the following:

- The Commission's existing Part 15 rules already ensure that carefully designed BPL systems do not cause interference.
- BPL implementations vary by vendor and may differ in their RF characteristics, but nonetheless can be compatible with licensed services.

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<sup>1</sup> Current Technologies was founded in July 2000 for the purposes of developing and implementing BPL technology. Current Technologies filed Comments and Reply Comments in this proceeding on July 7 and August 20, respectively.

- Real-world testing, accompanied by engineering analysis, supports our conclusions that Current Technologies' implementation of BPL does not cause harmful interference.
- BPL accelerates broadband competition with the "third wire."
- BPL has significant potential to advance Homeland Security and reliability of the electric grid.
- BPL married with broadband satellite can be a powerful force to serve rural areas.

The Commission should move swiftly with a Notice of Proposed Rulemaking recommending provisions that protect licensed users and facilitate the deployment of non-interfering BPL.

**1. Different BPL Vendors Use Solutions Having Different Technical Characteristics.**

Many filings in the proceeding lump together all BPL systems to form inaccurate conclusions that do not reflect the multitude of technical approaches that have been and can be taken by BPL vendors.

It is important to note that BPL is not one specific technology, as many of the filings assume, but rather is a *service* that makes use of powerlines for the transmission of broadband data. BPL implementations can vary in many respects, including:

- the modes of coupling the signal to the medium voltage power line;
- the form of signal processing and modulation used to carry information on the medium voltage power line;
- the frequencies used for transmission over the medium voltage line;
- the form of signal processing and modulation used to carry information on the low voltage power line;
- the frequencies used for transmission over the low voltage line; and
- the network configuration -- *e.g.*, use of repeaters.

This brief list demonstrates that each approach to BPL has its own set of characteristics affecting potential interference. Another vendor's BPL technology may differ from Current

Technologies' approach (see below) in radiating from the power line instead of from a point source, or in having multiple devices radiate simultaneously, or even in showing significant aggregation effects -- yet may still be fully compatible with licensed users. The Commission must create a technology-neutral regulatory framework that protects licensed users regardless of the details implemented in a specific BPL solution.

## 2. Current Technologies' Deployments in Two Cities Serving Over 200 Users for More than a Year Demonstrate Its Compatibility with Existing Users.

Current Technologies' earlier-filed comments explain in detail why its BPL systems do not interfere with radio communications.<sup>2</sup> We will simply summarize these points here.

First, BPL need not make an entire power line a source of RF radiation. Rather, Current Technologies' BPL emissions drop off rapidly with distance. The signal is detectable only from a few meters of line immediately adjacent to where the BPL device is attached. From a few meters away, the signal closely resembles that from a point source. See Current Technologies Figure 1. The often-stated claim in the docket that BPL creates a city-sized antenna due to the "unshielded and unbalanced" nature of power lines is incorrect, as shown in the test results plotted below:

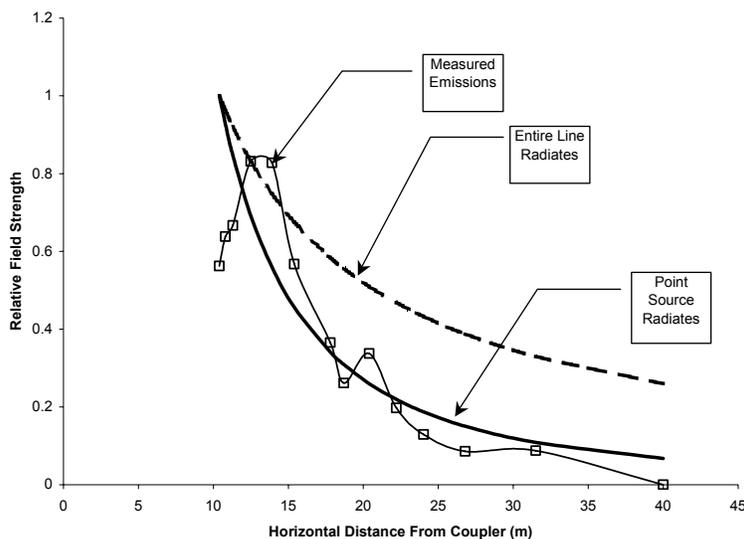


Figure 1

<sup>2</sup> See Reply Comments of Current Technologies, LLC at 9-13 (filed Aug. 20, 2003); Comments of Current Technologies, LLC at 14-16 (filed July 7, 2003).

Second, few BPL devices in Current Technologies' system that are close together can emit energy simultaneously, and those that do emit concurrently do so on different frequencies. Only one device on a medium-voltage distribution leg -- typically many blocks, or hundreds of meters, square -- transmits at a time. Using Time Division Duplex, each node in the network listens to ensure the network is clear before transmitting, so that only one transmitter operates at a time. Similarly, only one device in a low voltage distribution leg (*i.e.*, in the half-dozen or so residences served by a typical distribution transformer) can transmit at a time. This means only two BPL devices (one on the medium voltage segment and one on the low voltage segment) at most operate simultaneously in conjunction with a given transformer. And because the devices operate on different frequencies, they cannot affect the same receiver.

Third, Current Technologies' BPL emissions do not aggregate so as to create the potential for harmful interference. Because distribution transformers are typically spaced several tens to hundreds of meters apart, the density of Current Technologies' BPL devices operating at any instant is sparse. This, along with the fact that emissions from each device drop off rapidly with distance, ensures that no harmful aggregation of emissions can occur. As a result, emissions from multiple Current Technologies' devices do not accumulate in a victim receiver. Compared to signals from the nearest Current Technologies BPL emitter, the combined signals from all others are negligible.<sup>3</sup> Experience with Current Technologies' BPL deployments to date confirms the absence of harmful aggregation.

Finally, we emphasize that Current Technologies' compatibility with other users is *not* due to any single characteristic of the system. It is the cumulative and collective effect of these system attributes -- along with compliance with underlying Part 15 emissions limits -- that ensures the system is non-interfering. Careful system design by other vendors in accordance with Part 15 can provide similar spectrum compatibility.

### **3. BPL Is Compatible with Licensed Users and Will Not Increase the Noise Floor.**

Some claims in the filings suggest that BPL devices will raise the noise floor at 14 MHz by as much as 30 dB, from the present range of -163 to -170 dBW/Hz to a level of -140 dBW/Hz.<sup>4</sup> As Current Technologies demonstrates here, this claim represents:

- a misunderstanding of the distribution and operation of BPL devices; and

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<sup>3</sup> See Reply Comments of Current Technologies at 12 n.22.

<sup>4</sup> See Reply Comments of ARRL at 16. Several other commenters adopt ARRL's assertion and related conclusions without any scrutiny. See, e.g., Comments of Disaster Emergency Response Association, Inc. (pages unnumbered).

- the use of outdated studies, coupled with assumptions that are inconsistent with real-world implementation.

A BPL device below 30 MHz that satisfies the Section 15.209 limit of 30  $\mu\text{V}/\text{m}$  at 30 meters is equivalent to a transmitter having an EIRP of -45.7 dBm in a 9 kHz measurement bandwidth, or a power spectral density of -85.2 dBm/Hz.

As an example, ARRL in its filing assumes the absolute minimum loss possible in a 30-meter free space path of -24.9 dB at 14 MHz.<sup>5</sup> Thus, the power spectral density at a distance of 30 meters is -110.1 dBm/Hz or -140.1 dBW/Hz.<sup>6</sup> ARRL then takes this value of -140 dBW/Hz and uses it as the value for the "ambient man-made noise level."<sup>7</sup>

To continue the example, ARRL also uses a noise level from ITU-R P.372-8, an ITU Recommendation that has since been revised numerous times and is based on data measured in the 1970s and earlier. That document gives the value of noise level at 14 MHz as -163.5 dBW/Hz. It is questionable whether that figure is still valid. At least one recent study determined it is not.<sup>8</sup> ARRL also used the value of -170 dBW/Hz, which was a "best case" noise level measured in a quiet residential area

With these assumptions, ARRL then used a software simulation to predict the impact on HF communications due to raising the noise floor. ARRL concludes in its filing that an increase in the noise floor of 10 dB will have a significant effect on the reliability and range of amateur communications on HF frequencies. Following these assumptions, ARRL concludes that BPL devices will raise the noise floor either to -140.5 dBW/Hz, or at least by 10 dB over the existing noise floor.

This example from ARRL includes both assumptions and a logic flow that fail to represent the real world. In order to impact the noise floor as ARRL suggests, BPL devices would have to be deployed every 30 meters, and *all* would have to be active *all* the time. This is certainly not true of Current Technologies' equipment, as shown above. And the ARRL filing

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<sup>5</sup> See Comments of ARRL at 69.

<sup>6</sup> ARRL, using different equations, calculates an identical value of -140.1 dBW/Hz. See Comments of ARRL at 65.

<sup>7</sup> Comments of ARRL at 66.

<sup>8</sup> *Recent Measurements of Man-Made Noise in the United Kingdom -- Work Towards a Revision of Rec. Itu-R P.372*, ITU Radiocommunication Study Groups, Document 3j/15-E (Nov. 12, 2003).

also does not reflect that even with the multitude of possible BPL system designs, all of the systems so far have been (and continue to be) implemented along the same lines as Current Technologies' design -- as small neighborhood networks.

Moreover, certain BPL devices -- those designed for compatibility with the HomePlug® specification -- are designed to suppress signal levels by an additional 30 dB or more below the Part 15 limits on amateur frequencies. While this is a voluntary HomePlug® accommodation to amateur radio, and is not necessary to avoid interference to amateur radio transmissions, it reinforces and puts beyond question that HomePlug®-compatible BPL devices have no impact whatsoever on amateur frequency noise levels. Current Technologies' BPL system uses the HomePlug® signal set for its HF transmissions.<sup>9</sup>

#### **4. Claims of Inevitable BPL Interference Have No Scientific Basis.**

The docket contains a large volume of filings that broadly contend unintentional radiation from BPL systems will create harmful interference to licensed radio services throughout the HF band. Some of these assert that noise floor levels can potentially be raised to unacceptable levels (by as much as +55 dB).<sup>10</sup> But there is no support for these claims.

Current Technologies has confirmed through testing that its BPL systems are non-interfering. As one example, Current Technologies performed a worst-case direct test of interference on frequencies used by its system and also by licensed radios in the 30-50 MHz band. Far from the 30 dB (or more) noise floor increase posited by some commenters,<sup>11</sup> Current Technologies found an average effect of only 1 dB, and an absolute worst-case effect of 2.1 dB.<sup>12</sup> These low values have no practical consequence for radios operating even very close to BPL devices.

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<sup>9</sup> The HomePlug® specification has repeatedly received endorsement as effectively coexisting with amateur radio. *See HomePlug & ARRL Joint Test Report* (Jan. 24, 2001). Available at [www.arrl.org/tis/info/HTML/plc/files/HomePlug\\_ARRL\\_Dec\\_2000.pdf](http://www.arrl.org/tis/info/HTML/plc/files/HomePlug_ARRL_Dec_2000.pdf)

<sup>10</sup> *E.g.*, Comments of ARRL at 66; Comments of Disaster Emergency Response Association, Inc. (pages unnumbered). *See also* Comments of the Federal Emergency Management Agency (FEMA) at 3. FEMA recently clarified its position, specifically noting, "we have not concluded that there is a material interference problem [with BPL] or that all of the distinct technological approaches to BPL pose risk of interference." Letter from Under Secretary Michael D. Brown, U.S. Department of Homeland Security, Emergency Preparedness and Response, to Chairman Michael K. Powell, FCC (Jan. 8, 2004).

<sup>11</sup> *See* Comments of ARRL at 66.

<sup>12</sup> The worst case represents a licensed radio in a vehicle parked directly under a utility pole

**5. Interference *Into* BPL Is Not a Practical Or a Regulatory Concern.**

Some filed comments fear licensed radio-based systems might be blamed for causing interference *into* BPL systems.<sup>13</sup> This is not a realistic concern. None of Current Technologies' users for more than a year has reported problems that are or could be attributed to incoming radio interference. Even if a service disruption were to occur, the most technically sophisticated user would be unable to attribute it to incoming interference. Nor could the user specify the interfering frequencies, given that any licensed source typically operates over a far narrower band than does Current Technologies' BPL. In short, the user cannot identify the transmitter causing the interference. Any service-related complaints would inevitably come to the BPL service provider, who would have to determine how best to restore reliable service.

In any event, it turns Part 15 on its head to suggest that interference complaints from an *unlicensed user* against a licensed user might preclude the unlicensed use. Like any other supplier of unlicensed devices or services, the BPL vendor and service provider must both design equipment and networks that avoid harmful interference to licensed users and also bear the burden of any interference from third parties.

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on which Current Technologies' BPL equipment is installed and operating in the same band. Current Technologies conducted a test by establishing 20 dB quieting of the audio output with a signal generator and then exposing the radio to the ambient fields produced by a medium voltage device installation. The test setup was situated to expose the radio to maximum field levels directly under the medium voltage device to simulate a radio-equipped vehicle directly under the utility pole containing the BPL equipment. Tests were performed at four different frequencies, including a frequency with no BPL carrier as a control case. (The average measured level within this unused frequency can then be assigned to measurement bias.) The worst case test signal generator adjustment level required to restore 20 dB quieting was 2.1 dB. The average over all in-band channels was 1.6 dB. Average level within the unused BPL channel was 0.6 dB. If the measurement bias obtained from the notched channel is subtracted from the in-band channel measurements, the average interference level is a negligible 1 dB.

<sup>13</sup> *E.g.*, Comments of ARRL at 18.

## **6. BPL Supports Homeland Security Priorities.**

BPL deployment will enhance the country's emergency preparedness, not only by providing redundant communications channels, but also by offering enhanced restoration and reliability for the Nation's critical power distribution infrastructure.<sup>14</sup>

BPL enables utilities to offer enhanced power distribution services such as outage and restoration detection, power quality monitoring, load management, substation monitoring, and automated meter reading. Among other benefits, these provide outage protection that will benefit energy consumers who suffer through frequent localized incidents, like those incurred last September from Hurricane Isabel. In addition, the August 2003 blackout that shut down several states and parts of Canada highlighted unexpected fragilities in the interstate transmission grid. The Current Technologies BPL system permits utilities to monitor and better ensure security of critical facilities.

Government leaders have recently called for more investment and attention to improvement in power distribution generally. BPL is an integral part of that process, as it offers utilities a cost-efficient way to leverage their existing infrastructure to improve and maintain security and reliability of power distribution, as well as the internal communications systems needed to keep electricity flowing to consumers. In short, BPL directly supports U.S. homeland security priorities by improving the safety, reliability, and efficiency of power distribution.

## **7. BPL and Broadband Satellite Form a Complementary Network to Better Serve Rural America.**

The revolutionary promise of the Internet lies in having always-on broadband information resources available everywhere. There has long been a bottleneck at the "last mile" that separates the end user from the high-speed network. While some broadband providers are making inroads against this problem in certain urban core and close-in suburbs, existing technologies are not well suited to rural service. Indeed, the Commission's data show far lower broadband penetration in rural states than in urban states.<sup>15</sup>

The combination of broadband satellite and BPL potentially can offer the advantages of

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<sup>14</sup> See Comments of Southern Linc, Southern Telecom, Inc., and Southern Company Services, Inc. at 3-4; Comments of Hawaiian Electric Company, Inc. at 1-3; Comments of Cinergy Corp. At 3-4.

<sup>15</sup> *Federal Communications Commission Looks at Data on Growth of Broadband Subscribership In Rural Areas* (Released Aug. 6, 2003).

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the Internet where they are needed most. Last-mile broadband distribution via BPL will enable a provider to spread the costs of satellite earth station facilities over multiple households where the satellite functions as a backhaul method in a rural area. BPL will help reduce the cost of high-speed Internet access even in sparsely populated areas to levels comparable with those available to broadband customers in the major population centers. In many cases BPL will be the only provider offering service.

### **CONCLUSION**

This proceeding seeks ultimately to answer an important technical question: What Part 15 rules best enable the provision of BPL service while protecting other spectrum users?

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We ask the Commission to review the real-world technical evidence and analysis, including the Office of Engineering and Technology's field analyses of deployed BPL systems, to determine what new rules, if any, are required as BPL rolls out in the United States. The forthcoming Notice of Proposed Rulemaking should recommend rules that not only protect licensed users, but also facilitate the commercial deployment of BPL technologies. While we respect the concerns of those who have filed in the proceeding, the Commission should signal clearly that BPL is moving forward under rules that ensure its compatibility with other services.

Respectfully submitted,

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Counsel for Current Technologies, LLC

cc: Chairman Michael Powell  
Commissioner Kathleen Q. Abernathy  
Commissioner Michael J. Copps  
Commissioner Kevin J. Martin  
Commissioner Jonathan S. Adelstein  
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