

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

In the Matter of)	
)	
Amendment of Part 15 Regarding New Requirements and Measurement Guidelines For Access Broadband Over Power Line Systems)	ET Docket 04-37
)	
)	NPRM 04-29
)	

Via the ECFS

REPLY To Comments Made By All Access BPL Proponents

In light of the 27 April 2004 release of the National Telecommunications and Information Administration (NTIA) Report 04-413 (“Report”), and the Exhibits of the American Radio Relay League (ARRL) Comment of 3 May 2004, this Reply to Comments is made to all Access BPL proponents who have commented:

Amaren Energy Communication, Inc.	HomePlug Powerline Alliance
Ambient Corporation	Information Technology Industry Council
American Public Power Association	LecStar Telecommunications, Inc.
BellSouth Telecommunications	Main.Net Communications
Cinergy Corporation	PPL Telecom LLC
City of Manassas, Virginia	Progress Energy, Incorporated
Corridor Systems	Power Line Communications Association
Duke Energy Corporation	Southern Telecomm Incorporated
Echelon Corporation	United Powerline Council

With the single exception of Progress Energy, Incorporated, Comments of 3 May, 2004, **no** proponent of Access BPL has put forth **any test site measurements**.¹ Only the ARRL Comment attachments A through E and the NTIA Report have measurement data of incidental RF radiation of all three Access BPL test sites.² It is unconscionable that only a single proponent has put forth

¹ At Raleigh, North Carolina, test site employing mostly Access BPL equipment made by Amperion.

² NTIA Report 04-413, *Potential Interference from Broadband over Power Lines (BPL) Systems to Federal Government Radiocommunications*, Phase 1, April 2004, describes three different systems but does not identify their geographic locations. ARRL Attachment C identifies two test sites, Emmaus and Whitehall

any actual, measured incidental RF radiation levels yet they all claim to be within Part 15 regulations, complete with frivolous *assurances that their systems will not interfere with anyone*. Obviously they do yet the Commission's regulations are supposedly met.³

I make this Reply to Comments as a private citizen of the United States, a retired electronics engineer having no alliance to or allegiance with any radio organization or association either for or against Access BPL systems or components.

A. A Case of Radio Frequency *Pollution* From Access BPL To Existing Users Between 1.7 and 80 MHz

1. The Report identifies 13 Major Radio Services occupying the 1.7 to 80 MHz spectrum having 157 frequency bands. The government has over 59,000 federal assignments in that spectrum space, some of it vital to safety of life.⁴

2. There are 1 to 5 million Citizens Band Radio Service users in the United States.⁵

3. There are over 700 thousand licensed radio amateurs in the United States.⁶

4. There are at least 170 thousand model hobby enthusiasts operating on sixty 72 MHz optional-use, unlicensed channels for remote control of model vehicles.⁷

5. National Institute of Science and Technology (NIST) maintains time and frequency broadcasts at 2.5, 5, 10, 15, and 20 MHz on an exclusive, protected basis for all.⁸

6. There are seven major international broadcast bands between 5 and 26.1 MHz with an

Township, both in Pennsylvania. Manassas, Virginia, would be one test site as witnessed by the Comment from the City of Manassas on 3 May 2004. Progress Energy identifies Raleigh, NC, in their 3 May 2004 Comment. It is difficult to determine the exact number of Access BPL test sites in operation based on available documents.

³ There is *no* evidence that the Commission has actually measured *any Access BPL test site* to date, despite the ARRL Comment complaint mentions.

⁴ Appendix C of the Report identifies government users in detail.

⁵ NTIA estimate. Citizens Band Radio Service users are unlicensed and the actual numbers can only be determined approximately based on equipment sales history as reported by industry groups.

⁶ As of 1127 UTC on 9 May 2004, that number is 726,883 individual licensees according to data at website www.hamdata.com. With the exception of five channels at 60 meters, radio amateurs are not confined to single frequencies or bands and may freely operate in any Amateur Radio band.

⁷ Academy of Model Aeronautics membership numbers, the *AMA* being a national organization. Based on available radio-control sales, availability, the actual user number is higher than that. Part 95, Title 47 C.F.R.

⁸ Checking time and frequency to *WWV* has been standard practice for everyone from hobbyists to calibration laboratories for over a half century. That continues despite the new ubiquity of *radio clocks* that automatically update to 60 KHz transmissions from *WWVB*.

unknown number of listeners.⁹ That remains a popular pastime of a niche group regardless of the massive *AM/FM* band broadcasting availability from within the United States.

7. There are, literally, millions of citizens who depend, in some part, on relatively **free-from-interference reception** of a variety of radio signals between 1.7 and 80 MHz.¹⁰ The Commission has previously acted on keeping those many civil radio services free and clear since 1934. It should continue to do so.

B. Frivolity Of Simplistic Thinking That A Wire Or Two Can Connect Broadband Users Without Causing Incidental Radio Frequency Radiation

8. The Report, the ARRL, and several Commenters have stated that a single elevated wire **will become a radiator of Radio Frequencies (RF)**.¹¹ There should be no question that this is so since it is basic to the ability of any *antenna* to function. The amount of RF radiation is a function of its physical size, frequency of operation, and the level of injected RF. *Elevated electric power lines* throughout the United States vary widely in physical properties and **were never designed or installed for the purposes of carrying RF signals in the 1.7 to 80 MHz range.**

9. The least possible incidental RF radiation for Access BPL systems on elevated electric power lines occurs with a *balanced, differential-pair transverse-electromagnetic (TEM) physical and electrical operation*. However, that *TEM mode* is upset by **any discontinuities** along that wire pair. **Discontinuities** occur with a sudden change of wire pair spacing, changes in wire diameter, splice joints (which have the effect of changing physical size of the wire conductor for a short length), and connections from Medium Voltage (MV) to Lower Voltage (LV) distribution transformers. The effect is unpredictable since the United States electric power distribution system is designed for 60 Hz electric power frequency. **United States electric power distribution lines were never designed to operate over a 1.7 to 80 MHz frequency span.**

10. Discontinuities along an electrical power distribution line will have the effect of reducing the amount of RF energy conveyed along that line, whether a single wire or wire pair. In order to maintain an adequate customer receive level for Access BPL signals, the choice is that of either increasing the source end injection energy or employing amplifiers along the line or both. The amount of incidental RF radiation from an Access BPL system will be proportional to the RF level

⁹ International broadcast bands, all three Regions. There is no easy gauge of the number of listeners to the *shortwave broadcast bands* in the United States yet periodicals of interest to such listeners have been popular for over a half century and there are a number of membership organizations for such *shortwave listeners* in the United States.

¹⁰ Modelers using 72 MHz remote-control channels operate one-way and depend on the remote receivers' ability to retain control over a \$50 to \$500 model vehicle.

¹¹ Among individual Commenters, that of Cortland Richmond filed on 3 May 2004. In this Reply to Comments, the term **RF** applies to any frequency above 60 Hz and especially to the 1.7 to 80 MHz frequency range expected for Access BPL systems.

of the Access BPL signal at its highest power level.¹² Yet, the Access BPL proponents are adamant in their **claims of never exceeding** existing Part 15 levels!

11. The elevated electrical power distribution lines **cannot be regarded as point sources** in terms of small appliance devices being point sources. Those electric lines must be treated as **radiating single wires** or as discontinuity-induced **radiating differential pairs** attempting to operate as TEM mode transmission lines.¹³ Analytical modeling can only attempt so-called *typical* line models as they *might* occur in a given community. **The United States electric power distribution system was designed to safely handle a variety of alternating current voltages operating at 60 Hz. It was never designed to operate with a physical uniformity necessary for frequencies given for Access BPL systems.**

12. It might be *intuitive* for the ignorant to see an electrical power line going to a rural community as some sort of *built-in path for broadband*. **That is no justification in regards to regulations which have to do with precise technical limits.** The Access BPL bandwidth covers about 5 ½ octaves from 1.7 to 80 MHz and, in terms more familiar to electrical engineering disciplines is *very wideband*. Talking and making pronouncements about Access BPL installation and advantages as if this technical feat was as simple as wiring up a doorbell is nothing short of ridiculous. **None** of the Access BPL test sites pictured in the Report or the ARRL Attachment or the Progress Energy Comment attachment show any **rural** installation.

C. Access BPL Is An *Exciting New Service Which Should Not Be Overly-Regulated*

13. *Excitement* was a poor word choice of the Commission when NPRM 04-29 was first released. It should have been obvious from the first Notice of Inquiry that the frequency range for Access BPL would impinge on many already-established radio services and assignments.

14. Access BPL systems **will radiate incidental RF noise**. The question is **how much?** That information was partly filled in by the Report and the ARRL attachment test site measurements. **Both documents indicate excessive incidental RF radiation above existing Part 15 limits.** Despite all the *excitement* over this new service, not a single shred of evidence was forthcoming in the NOI period from any of the proponents despite already-installed test sites. It remained for other radio service users to point out the incidental RF radiation from those test systems.

15. It seems the general opinion of Access BPL proponents that all such systems be given

¹² No Access BPL system has been described to date in terms of signal levels at the customer or along the major distribution routing. No one can hope to set any standards or evaluate any such system without that information.

¹³ Some Access BPL proponents attempt to draw a parallel to existing cable TV service coaxial lines or to telephone line pairs. Nearly all TV coaxial cables maintain their TEM mode *within* the cable between inner conductor and outer shield. Some leakage does occur but it is at a very low relative level and is addressed in another Part of Title 47 C.F.R. Cable TV systems maintain strict uniformity of the distribution coaxial cable properties, thereby reducing all system discontinuities to a minimum. Telephone subscriber wire pairs are twisted to reduce cross-coupling as well as maintaining the differential-pair balance. In addition, telephone cables have a conducting outer sheath as animal protection; that conductive sheath helps to further attenuate any signal leakage. By comparison, elevated electric power lines are quite open and at the highest levels on utility poles. There can be no justifiable comparison of either to electric power distribution lines attempting to convey RF signals.

carte blanche as to what they do in the interests of *promotion of their service*. Never mind the local interference to a dozen other radio services using 1.7 to 80 MHz, just give the Access BPL what they want. All in the interests of *newness* and promotion of new markets.

16. One of the most egregious statements is that of Duke Energy in their Comments of 3 May 2004 at subheading C on page 7, “*FCC Should Not Dictate A Range of Frequencies or Require Frequency Exclusion Capability.*”¹⁴ Duke Energy’s legal representative should be reminded that the Commission is legally bound to regulate and mitigate **all RF energy transmission in United States civil radio**, from 9 KHz to 300 GHz.

17. Apparently the Commission is also caught up in this *new excitement* in that the Commission denied an extension of time to study the NTIA Report released on 27 April 2004. There were 6 separate pleadings for time extension, all filed prior to the Report release. The denial notice, DA-04-1175, was issued 30 April 2004. The NTIA Report is a **two-volume** document totaling **266 pages**. Interested parties had only 3 to 5 days to obtain both volumes from the NTIA, then study this massive Report before the end date of Comments on 3 May 2004.¹⁵ Oddly enough, an extension of time of two weeks was granted in DA-03-4096 on the basis of a single pleading for ET Docket 03-201.¹⁶ The disparity should be obvious since NPRM 03-223 was a total of only 35 pages, including some Commissioner’s statements. The aggregate of all previous Comments on Docket ET 03-201 did not total 266 pages, yet a two-week extension was granted on it but not on 04-37.

D. Access BPL Must Be Kept *Secret* For Privacy Reasons And For *Homeland Security*

18. Several Access BPL proponents insist on *privacy of details* so as not to reveal customer information. While that is a laudable goal, there is **no** justification when the incidental RF radiation from an Access BPL system affects thousands of the general public throughout any such system installation. No critic of Access BPL has suggested revelation of a system’s customer base, only in the technical details of an installed Access BPL system.

19. The incidental RF radiation technical details from an Access BPL system may be quantified by direct, non-intrusive measurement.¹⁷ The incidental RF radiation is the interference

¹⁴ The *exclusion* part of the section heading is obviously against any techniques of *notching* as an attempt to reduce specific RF energy content on certain band segments.

¹⁵ Since the Commission does not relay applicable other-agency information, we non-agency citizens are obliged to constantly monitor those other agencies.

¹⁶ Docket ET 03-201 concerns NPRM 03-223, *Modification of Parts 2 and 15 of the Commission’s Rules for Unlicensed Devices and Equipment Approval*, released 17 September 2003. DA-03-4096 was released 24 December 2003 on the plea of Navini Networks made on 18 December 2003.

¹⁷ That is done in the Report, principally in Volume 2 of the two-volume set.

medium, **not the content** of any Access BPL system.¹⁸

20. There is no need for privacy protection due to any revelation of *trade secrets* in Access BPL components or means of attachment. Incidental RF radiation from Access BPL systems **will occur** and that radiation, **not the system trade secrets**, is the potential interference source to receivers. Incidental RF radiation is **not protected by law**. The legal task of the Commission is to enforce **non-interference** to other radio services.

21. Some proponents of Access BPL have cited *Homeland Security* as an alleged need to have privacy about installed systems.¹⁹ Access BPL systems operate **on the existing electric power distribution system**. Those electric power lines' routes are **already known**, either by direct visual observation or from documents available from various local government offices as well as from some electric power utility companies.²⁰

22. Interference contact telephone numbers and addresses **must be available to the public** due to their potential interference effect on so many radio services. There is precedence in this from the Commission's own databases on civil radio service transmitter locations, from broadcasting services to amateur radio licensee addresses.

E. Adaptive Filtering Means On Access BPL Systems To Minimize Interference?

23. Adaptive Filtering of Access BPL data transmission, either by *notching* their spectral content or by data waveshaping to avoid sideband content in certain special portions of their spectrum is, at best, a stop-gap measure applicable **only to very small Access BPL system installations or locations**. Considering that the **entirety** of the 1.7 to 80 MHz spectrum region is allocated to at least one civil radio service in the United States, it is **impossible** for any large Access BPL to effectively reduce incidental RF radiation interference to **all** radio service users. The broadband data distribution medium of an Access BPL system, a giant antenna of MV electric power lines, is **not a point source** such as a small wall-plug telephone or in-house network coupler connection. In any urban area of the United States, the interference potential exists for **all radio service users** of the 1.7 to 80 MHz spectrum.

¹⁸ There are many means of securing the **content** of digital data for reasons of privacy, such as the 128-bit DES means presently employed by many websites on the Internet today. Digital data, whether *in-clear* or encrypted, acts as a *pseudo-random noise source* to relatively narrow band receivers. As random sources, all noise powers **add algebraically**.

¹⁹ *Homeland Security* did not exist per se as a federal agency prior to the Attack on America on 11 September, 2001. The first instance of actual electric power line use as a high-speed medium for broadband data was in Norway in 1997, referenced in the reports from NORDAC 2000 conference in Trondheim, 22 - 23 May 2000. European terms equivalent to Access BPL are *PLT* for *Power Line Telecommunications* or *PLC* for *Power Line Communications*.

²⁰ General details of the High Voltage or HV interstate and intrastate electric power distribution system has been available on the Internet and from the State of California since the year 2000 and the investigations into the California electric power rate increases of that year. HV grids are more likely targets for terrorist actions due to their effect on millions of customers rather than the thousands in local communities. HV grids' locations throughout the West Coast are easily seen and located by eye.

24. If *notching* or other adaptive filtering techniques are used on an Access BPL system, the question evolves to **which radio service** shall get the interference reduction privilege? Amateur radio bands are generally, but not wholly harmonically-related. Radio amateurs would be the most likely interference victims in residential locations and radio amateurs also have several membership organizations for representation. However, HF broadcast listeners are not licensed and have few national membership organizations and those would likely be located in residential locations as well. So too would those radio-electronics hobbyists who use NTIS time and frequency broadcasts on HF.²¹ While most of the 1 to 5 million estimated 27 MHz Citizens Band radio users appear to operate mobile, some are also located in residential areas.²²

F. *Mitigation Fallacy And Access BPL Service Shut-Down Based on Interference*

25. Any Access BPL service provider would be expected to follow the Internet Service Provider established 24-hour operating policies. The *broadband* nature can be taken to be synonymous with Internet-available data services.²³ It would be advantageous financially for all Access BPL providers to maintain 24-hour service to all customers. The need for such 24-hour service, indeed the expectation of same, **precludes any possibility of Access BPL shut-down or other interference mitigation action reduction in service.** Mitigation, per se, is not an option.

26. Access BPL system installation and operation **must** be done with a **minimum of incidental RF radiation level** within the 1.7 to 80 MHz spectrum region. On the basis that this frequency range is already occupied by established radio services, both civil and governmental, and the extent of the Access BPL distribution system (electric power wires), it is requested that the maximum level be changed to that of the German *NB30* limit of

$$\text{Field Strength (db } \mu\text{V / meter)} = 40 - 8.8 \log_{10}(F_{\text{MHz}})$$

at a distance of 3 meters with a peak-reading detector through a 9 KHz bandwidth. Above 30 MHz the Field Strength would remain at 27 db $\mu\text{V/meter}$. This is approximately 30 db below the desired incidental RF radiation limits of some Access BPL proponents at about 2 MHz as shown in Figure

²¹ A few areas of the United States do not enjoy 24-hour reception of WWVB on 60 KHz for time and frequency reference, thus metrology laboratories in those United States locations would require reference to the HF time-frequency broadcasts from 2.5 to 20 MHz. Those WWV and WWVH frequencies **are** harmonically-related.

²² The emphasis on *residential areas* for affected receivers is based on informal observation of urban areas and the likelihood of a more random distribution of those receivers in wide residential areas. An obvious indicator is the presence of HF antennas at such residences. Similar informal observation, via HF antenna presence, would indicate that government users of HF assignments would be either in the center of urban areas or at the fringes. There is no quantifiable data on CB radio use although it is obvious there are many mobile users on highways from obvious antennas on the cabs of truck vehicles.

²³ Except for periodic equipment maintenance announced well in advance, Internet Service Providers operate 24-hours-a-day, 7-days-a-week. The Internet *backbone* remains in 24-hour operation in that it is not dependent on any one pathway but rather several in parallel. Telephone, TV cable, electric power, natural gas, and water utilities all operate on a 24-hour basis in the United States.

3-1 of the NTIA Report.²⁴

27. Should any interference victim have their complaints investigated and found to be true, **corrective action on the part of the Access BPL service provider shall be mandatory beyond a 3 meter distance from the Access BPL MV distribution line.** Access BPL proponents do not get *carte blanche* to interfere with established radio services. There is **no valid reason** for high levels of Access BPL signals other than as a convenience for the Access BPL systems. The so-named *new and exciting* prospect of Access BPL **shall not be a cause to interfere with established radio services.**

28. It is unreasonable to expect Access BPL system operators to willingly reduce power levels on the basis of interference reports. That would, in all probability, cause some loss of signal to an from some Access BPL subscribers. Installed and operating Access BPL systems owe their subscribers for keeping subscriber throughput available. If an Access BPL system will run at reduced distribution line signal levels and still maintain subscriber services, **it should continue to run at such reduced distribution line signal levels.**²⁵

29. If any Access BPL system experiences any interference to Access BPL communications from licensed radio services and that licensed radio service transmitter and antenna combination and operation is found to be within regulations pertaining to that radio service, **it shall be the task of the Access BPL system to make itself more robust to withstand such interference.** Access BPL systems are not yet a proven technology for broadband communications despite their alleged *new and exciting possibilities.*²⁶ Access BPL is **not owed** anything in terms of excluding all other licensed radio services. There are many and varied forms of other broadband service available to all citizens **now.**

30. *Mitigation* of interference is of no use when certain, non-harmonically-related frequencies are interfered with in safety-of-life communications indicated in the NTIA Report. Mitigation occurs after-the-fact. The purpose of regulation of various radio services, and also in cooperation with the NTIA for government radio users, is to establish clear band segments within the electromagnetic spectrum. Those band segments become useless when each radio service receiver is inundated with pseudo-random noise from Access BPL systems. It would seem the best policy to **keep Access BPL distribution line signal levels low enough to permit radio services to reasonably operate.**

²⁴ Page 3-5, Volume 1 of 2. See also pages 3-3 through 3-5 of Volume 1 for comparative tables.

²⁵ This is in line with all Commission-regulated radio services' regulations requiring using the lowest-possible transmitter RF output to maintain any radio circuit.

²⁶ Existing broadband providers are POTS or the Plain Old Telephone System, Digital Subscriber Lines through either telephone circuits or via Community Access Television cable service, wireless or radio communications links well above 80 MHz such as the *Wi-Fi* or *Wi-Max* standards exemplified by IEEE Standard 802.16 systems. According to *High-Speed Services for Internet Access: Status as of June 30, 2003*, an attachment to GN Docket 04-54 there existed over 23.4 million high-speed lines with at least 200 KBPS in one direction in the United States in mid-2003. It seems intuitive that wireless access up to 30 miles would better serve rural communities than the Access BPL system approach which will add to the RF pollution of the 1.7 to 80 MHz spectrum.

CONCLUSION

Broadband service availability is a good thing for the entire United States. There remains only a dispute on how best to accomplish that end goal. Broadband services should not displace established radio services and licensed stations, civil or government, in bringing that to each citizen. If new broadband systems are to serve the nation, they should operate on clear frequencies or over shielded, protected communications signal carrying means. Access BPL systems have the potential for direct interference with established, licensed radio communications and must have operating standards to minimize such interference. The level of incidental RF radiation from Access BPL systems should be reduced from existing Part 15 levels to at least that done in Germany.

I thank the Commission for providing an open forum for citizens to voice their concerns directly to their government, including myself, a retired electronics design engineer fortunate to have had a half-century career in many radio disciplines including that of radio communications..

Respectfully submitted this 11th day of May, 2004,

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