Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Carrier Current Systems, including Broadband over Power Line Systems	)	ET Docket No. 03-104
	)	
	)	
Amendment of Part 15 regarding new requirements and measurement guidelines for Access Broadband over Power Line Systems	)	ET Docket No. 04-37

To: The Commission

May 3, 2004

COMMENTS OF GERALD W. MURRAY, WA2IWW

1. Background

My name is Gerald W. Murray. I have held Amateur Radio license WA2IWW since 1976, and have held the Amateur Extra class license since 1992. I also hold the following FCC commercial radio operator licenses:

- General Radiotelephone Operator License (GROL) with Ship Radar Endorsement
- Second Class Radiotelegraph Operator's Certificate with Ship Radar Endorsement
- GMDSS Radio Operator/Maintainer License with Ship Radar Endorsement

I am currently employed as a Data Communications Specialist II by the New York State Workers' Compensation Board (NYSWCB). I had previously been employed as a broadcast operator by AM and FM broadcast stations in Upstate New York's Capital District Area.

2. Deployments

As an amateur radio operator, I have proudly volunteered to provide community service for the following events:

- American Red Cross, "Storm of the Century", 3/13/1993 – 3/14/1993
- New York State Emergency Management Office, Ice Storm '98, , 1/10/1998 – 1/23/1998
- New York State Emergency Management Office, Y2K Event, 12/31/1999 – 1/1/2000
- Schenectady (NY) Emergency Operations Center, Verizon Central Office Flood/Telephone Service Disruption, 12/28/2000
- New York State Emergency Management Office, 9/11 Terrorist Attacks, 9/11/2001 – 9/12/2001

3. Affiliations

I joined the American Red Cross in January of 2003, and recently joined Air Force MARS (Military Affiliate Radio Service), and the Citizen's Corps. However, my comments and opinions are my own, and do not necessarily reflect the opinions of the American National Red Cross, the Military Affiliate Radio Service, or the Citizens Corps. Any information provided about Red Cross radio systems is publicly available from FCC databases.

4. "Rush to Judgment"

The Commission appears to be "rushing to judgment" in this proceeding. The Commission has declined to grant request for "extensions of time" to allow parties sufficient time to review reports submitted by the NTIA and others. The ARRL request for an extension of time was filed on April 9, 2004. At that time, the expected release date of the NTIA report was mid-April, 2004.

NTIA Report 04-413, *Potential Interference From Broadband Over Power Line (BPL) Systems To Federal Government Radiocommunications at 1.7-80 MHz, Phase 1 Study, Volume I* was finally released on April 27, 2004.

The Commission released its denial of all of the extension of time requests on April 30, even through the NTIA report was not released until April 27. This gave all interested parties less than one week to review the voluminous, highly-detailed two-volume report and address it in their comments.

5. Questionable Claims and Assertions in the NPRM

Many of the statements and assertions made in the NPRM and in other forums are questionable and/or unsupported. Commissioner Adelstein has stated that "we cannot let unsupported claims stand in the way of such an innovation as BPL systems". However, Commissioner Adelstein does not say which claims he believes to be unsupported. Voluminous evidence to support the claims exists in the record for the NOI and the NPRM. These include technical reports submitted by the ARRL and others. These are outlined in Appendix B of NTIA Report 04-413. The ARRL Web Site (www.arrl.org) also contains audio and video clips of actual BPL interference.

6. Lack of Utility Compliance with and FCC Enforcement of Harmful Interference Requirements Used to Justify Additional Harmful Interference From BPL.

The Commission appears to be using the current existence of harmful power line interference (unrelated to BPL) as a justification for the introduction of additional harmful interference due to BPL. Paragraph 35 of the notice states:

> *"We note that ARRL acknowledges that noise from power lines, absent any Access BPL signals, already presents a significant problem for amateur communications. We therefore would expect that, in practice, many amateurs*

already orient their antennas to minimize the reception of emissions from nearby electric power lines."

This suggestion asks victims of harmful interference to accept and tolerate it, thereby turning the requirements for operators of unlicensed Part 15 devices to prevent harmful interference to licensed radio services completely inside out. Power line interference (and unwanted signals from BPL systems) constitute "electromagnetic pollution". Asking amateur licensees to "orient their antennas" in this situation is similar to asking victims of air pollution to "hold their breath", or advising residents living near contaminated wells or waterways "do not drink the water". This suggestion would be unacceptable for any other licensed radio service. It begs the question as to why anyone would feel that it is appropriate for the amateur radio service, which should enjoy the same level of protection under the regulations as any other licensed radio service.

In any event, this solution is completely impractical in many cases. Many existing power line interference sources and amateur radio antennas exhibit little or no gain or directivity. Re-orientation of antennas in this situation would provide little change.

7. Commissioners acting as "BPL Cheerleaders" Rather Than as Impartial Judges in a Rule-Making Proceeding.

Many of the Commissioners have been strong advocates of BPL, and strongly express a desire to bring a new method of broadband delivery to subscribers. Would they also be willing to take credit for causing harmful interference to the radio stations in Aeronautical Radionavigation, Amateur, Amateur Satellite, Broadcasting, Fixed, Land Mobile, Aeronautical Mobile, Maritime Mobile, Radioastronomy, Radiolocation, Space Research, Standard Frequency and Time Station Services?

8. NTIA Findings of Interference and Potential Interference

NTIA Report 04-413, Potential Interference From Broadband Over Power Line (BPL) Systems To Federal Government Radiocommunications at 1.7-80 MHz, Phase 1 Study, Volume I was finally released on April 27, 2004. The NTIA lists the following findings in the Executive Summary:

- Critical review of the assumptions underlying these analyses revealed that application of existing Part 15 compliance measurement procedures for BPL systems results in significant underestimation of peak field strength.
- Underestimation of the actual field strength is the leading contributor to high interference risks.
- As applied in current practice to BPL systems, Part 15 measurement guidelines do not address unique physical and electromagnetic characteristics of BPL radiated emissions.
- Accordingly, NTIA does not recommend that the FCC relax Part 15 field strength limits for BPL systems.
- NTIA recommends several "access" BPL compliance measurement provisions that derive from existing Part 15 measurement guidelines.
- Among these are requirements to:
    - Use measurement antenna heights near the height of power lines;
    - Measure at a uniform distance of ten (10) meters from the BPL device and power lines;
    - And measure using a calibrated rod antenna or a loop antenna in connection with appropriate factors relating magnetic and electric field strength levels at frequencies below 30 MHz.
    -

9. NTIA Recommendation 8.2, Power Level

> *The single most effective method for reducing the potential for harmful interference from a BPL device may be to reduce the RF power it generates. As the FCC notes in §15.15(c), "…the limits specified in this part will not prevent harmful interference under all circumstances. Since the operators of part 15 devices are required to cease operation should harmful interference occur to authorized users of the radio frequency spectrum, the parties responsible for equipment compliance are encouraged to employ the minimum field strength necessary for communications…" The minimum signal power necessary for BPL communications will obviously depend upon the system configuration used and the specific characteristics of the power line network. In some cases, reduction of BPL*

> *device output power may reduce data throughput. Throughput could be restored to the previous levels in existing BPL deployments by the addition of repeaters or in planned new deployments by reducing separation distances between devices. Consistent with §15.15(c) BPL systems should use the least power needed to carry out power line communications.*

As noted by the NTIA, the proposed reductions in power levels to reduce the potential for harmful interference may reduce data throughput. This is because the reduced BPL signal levels would have a reduced signal to noise radio with respect to the noise floor. The error rate would increase, thereby increasing the number of data transmissions (retries), and increasing latency and response time.

The suggestion that throughput lost as a result of lowering power levels could be restored by the addition of repeaters or by reducing separation distances between devices would increase the number of active BPL devices in a given geographic area. Although each of the devices would be operating at a decreased power level, the number of concurrently active devices in the same geographic area would increase. This would act to increase the noise floor in the entire area.

Also the suggestion for an increase the number and the reduction of separation distances between devices would increase the BPL operator's costs in designing, installing, maintaining and operating the system.

10. NTIA Recommendation 8.3, Avoidance of Locally Used Frequencies

> *Several access BPL systems make use of technology that can enable the avoidance of certain frequencies and frequency bands through capabilities for shifting BPL signal frequencies or notching or filtering out of BPL signals on those frequencies. Various FCC filings have indicated that this type of mitigation technique would not only be possible, but in fact has already been implemented to reduce BPL interference issues.*
>
> *Another more advanced method of frequency avoidance would be agile or adaptive filtering. Unlike fixed frequency notching, systems with agile frequency avoidance would monitor frequency bands and dynamically change their frequency usage to avoid radio channels on which strong signals were detected. This is a solution that might enable increased interference-free use of the RF spectrum by BPL systems. However, there is significant concern that such a system, even if it were to work instantaneously, would not reduce the interference potential to systems operating in duplex mode or local weak-signal reception. Interference to these operations may be discovered at the same time effective radio communications are needed most. Rather, this technique would protect only those radiocommunications using simplex mode and originating from a local radio transmitter.*
>
> *A more basic form of adaptive filtering should be considered as a requirement. Again, it must be recognized that BPL systems may be susceptible to disabling if subjected to signals from a powerful, nearby transmitter. To the extent that this vulnerability exists, which is a vulnerability commonly found in all kinds of electronic systems, BPL systems must inherently avoid operating at frequencies used by powerful, local radio transmitters.*

This technique would only react to strong, local signals. It would not react to low-power transmissions. The only way for a local station to overcome this would be to increase power (if possible).

As noted by the NTIA, this technique will not provide relief for stations operating in duplex mode (split frequency operation).

§97.313 Requires amateur radio stations to use the minimum transmitter power necessary to carry out the desired communications. Other radio services have similar requirements to use the minimum power necessary.

Amateur stations may be required to increase their power level beyond what would otherwise be required to trigger the adaptive filtering technique. In some cases, this may require power levels which are higher than the stations can safely produce and/or higher than what the rules allow.

There does not seem to be any stated or implied requirement as to how quickly a BPL system should react to the presence of a signal, or how long a frequency should remain quiet before it is re-used by the BPL system.

This suggestion is also problematic for a radio "network" which is conducted for normal amateur radio communications, disaster drills and exercises, or actual disaster relief operations. In such networks, several stations are listening on the same frequency, while only one station is transmitting at a time. This all occurs in an orderly fashion under the direction of a Net Control Station (NCS). Amateur stations located near a BPL installation will often miss other station's transmissions whenever a BPL device resumes operation on what it believes to be an "unused frequency". The only way for the amateur station to rectify this situation would be to trigger the adaptive filtering mechanism by transmitting on top of other ongoing transmissions. This is rude, and constitutes very poor amateur practice. It is also contrary to the rules.

This suggestion also causes problems for stations using Automatic Link Establishment (ALE). These stations are used by Federal Government Agencies, the military, the various branches of the Military Affiliate Radio Service (MARS), the American National Red Cross, and by some amateurs. ALE stations operating near BPL installations would not be able to hear or respond to requests for link activation which are received from other stations.

This technique also provides no protection for listeners and receivers in the shortwave and utility services, or to radioastronomy stations. These stations do not transmit, and cannot make their presence known to the BPL devices.

The NTIA statement that "This is a solution that might enable increased interference-free use of the RF spectrum by BPL systems" indicates that this solution has not been proven at this time.

In this section, the NTIA also recognizes the possibility that BPL systems may be susceptible to disabling if subjected to signals from a powerful, nearby transmitter. This possibility has been repeatedly downplayed by many BPL proponents.

11. NTIA Recommentation 8.4, Differential Mode Injection

> *The use of unshielded, twin-lead lines for achieving non-radiating signal transmission depends on differential or balanced line driving (as well as fundamental balance in the lines themselves). In this conceptual mode of signal injection, a signal of equal magnitude and opposite phase is placed simultaneously on both wires, resulting in cancellation of radiation in the far-field. While balanced transmission lines are usually constructed with very small wire spacing relative to the wavelength of the signal, preliminary NTIA NEC modeling of long wires using power-line dimensions, typical loads to neutral lines, and various grounding configurations has shows a decrease of several decibels in RF radiation for balanced differential BPL signal injection as opposed to non-differential*

> *injection At least one BPL manufacturer, in its comments to the FCC, indicated that differential mode-driving should reduce signal radiation as well.*
>
> *It should be noted, however, that inherently unbalanced systems such as power lines (due to multiple grounds and transformer taps) will not act as true balanced transmission lines regardless of the method of signal injection. Thus this method of interference mitigation is limited in impact by the power line configuration.*
>
> *Further reductions in radiated emissions may be possible using unbalanced driving of the unbalanced power and neutral lines, and there may exist ways to couple to all power lines in a manner that yields lower radiated emissions while achieving relatively high BPL signal currents and throughput. NTIA encourages further investigation of these possible solutions by BPL developers as appropriate.*

As noted by the NTIA, power line systems are inherently unbalanced, and will not act as true balanced transmission lines regardless of the method of signal injection. In addition, the degree of imbalance may change due to changes in the topology of the power distribution network (new customer connections, customer disconnections, service entrance upgrades) as well as gradual deterioration of the power lines and other related components over time.

The fact that "NTIA encourages further investigation of these possible solutions by BPL developers as appropriate" indicates that these assumptions are not proven at this time.

12. NTIA Recommendation 8.5, Filters and Signal Terminations

> *Typical BPL signals will travel for at least several hundred meters along power lines before losses attenuate them to below useable levels. In many cases, conduction of BPL signals over these distances is unnecessary, as it means signals may continue far past the couplers, repeaters and customers for whom they are intended. Additionally,, frequency re-use for BPL, systems may be an issue for closely-spaced cells that renders conduction of BPL signals over extended distances undesirable.*
>
> *One way to prevent unnecessary signal conduction is to make use of terminations or blocking filters on the transmission line. Since BPL signals are much higher in frequency that the 60 Hz power carrier, such terminations might range from the very simple (a large ferrite bead placed around the power line) to complex (for example, a system that inductively retransmits the signal out-of-phase with the original in a manner that does not disrupt BPL signal reception). Ideally, such a filter would absorb, rather than reflect, the incoming signal.*
>
> *Additionally, the installation of filters on low-voltage distribution wiring before it enters a premises could help to prevent in-house interference to radio reception from BPL signal leakage. At least one relevant patent on such a filter was recently issued.*
>
> *Although NTIA's studies were focused on outdoor wiring and Federal Government radio systems, it should be recognized that in many cases filtering techniques may reduce interference to other radio receivers that may be vulnerable to interference from signals radiated by indoor LV wiring.*

The statement that "filtering techniques may reduce interference to other radio receivers " indicates that this assumption has not been proven at this time.

13. NTIA Recommendation 8.6, Implementation of a "One Active Device Per Area" Rule

> *Several manufacturers have noted that BPL devices in a given area tend to transmit one at a time, and their signals therefore do not aggregate. Making such a configuration standard practice (i.e., only using one power line phase in a given area and only one signal injection point per wire) would help to insure such were the case, at least for a local receiver.*

This would be similar to polled environments (such as the old bisync 3270 or SNA/SDLC data communications protocols), or to a CSMA/CD contention scheme (used by Ethernet and other data communications protocols). Only one station (the control point, or one of the individual subscribers) could transmit at any given time. This limitation would tend to limit throughput, and to increase system response time and latency. System performance would tend to degrade exponentially as system utilization increases due to increases in the number of subscribers and/or increases in the amount of traffic.

14. NTIA Recommendation 8.7, Judicious Signal Carrier Choice

> *Due to the specific physical and electrical characteristics of a given section of power line, it is conceptually possible to find one or more frequency bands at which BPL signal radiation is relatively low. Specifically, on a case-by-base basis during installation or operation, it is theoretically possible to consistently preclude worst-base radiation conditions through avoidance of combinations of certain frequencies and coupler placement geometry (relative to power line impedance discontinuities that yield worst-case radiation. NTIA's studies have only partially addressed frequency selective characteristics of BPL radiation, but work to date indicates that less than 50% of possible operating frequencies will exhibit this low-radiation characteristic.*
>
> *To implement this concept, detailed measurements may be needed at every installation site to reliably identify frequency and coupler placement combinations that should be avoided. It likely would be found that use of a substantial amount of bandwidth be precluded at each segment of a BPL network NTIA welcomes further investigation of this concept by BPL proponents because if practicable, BPL devices could operate at higher signal power levels while still complying with field strength limits.*

If the suggested practice of performing detailed measurements at every installation were followed, it would tend to increase the costs borne by the BPL system operator.

The statement that "NTIA welcomes further investigation of this concept" indicates that it has not been proven at this time.

15. NTIA Recommendation 8.8, Maintenance of a Single Point of Control

> *In order to improve the resolution of actual cases of harmful interference, it would be prudent to have one entity in a service area controlling all the devices in that area, as well as one contact point for that entity. This contact point should be capable of addressing cases of suspected interference and resolving actual harmful interference through any and all means available to the BPL provider, without government intervention.*

The Proposal contains no information on procedures to be followed for when handling complaints, nor does it specify a timeframe in which the interference problem is to be resolved.

In actual practice, electric utilities often fall short with respect to their current obligations to prevent harmful interference as described in §15.5, §15.13, and §15.15. The FCC Enforcement Bureau has had to send out numerous letters to various electric utilities advising them of their obligations under Part 15.

16. NTIA Recommendation 8.9, Web-Based Access to Radio License Information

> *Knowing what radio operations are located in their immediate environment should facilitate BPL operators in selecting frequencies, power and other technical parameters that minimize interference. The FCC and NTIA both maintain databases of licensed/authorized radio systems across the radio spectrum, including the 1.7-80 MHz frequency range. The possibility of making parts of the NTIA database available to appropriate persons via a web-based mechanism will be further investigated by NTIA. However, it should be recognized at the outset that such an approach could, at most, be only a partial solution due to the nature of such data bases. For example, many frequency assignments are registered for nationwide use rather than use at a specific location. Also numerous uses are not publicly releasable*

Some radio systems are licensed and authorized to operate over large area, such as entire counties, multiple counties, entire states, multiple states, the continental US (CONUS), and even the entire US (including all possessions).

Once such system is licensed to the American National Radio Cross under the call sign KNNP491. This system consists of 1,000 100-watt transmitters which are classified as fixed base temporary (FBT). A copy of this license is included as an attachment.

The authorized area of operation for this system is nationwide, including all U.S. Possessions. Accordingly, these systems are deployed by the American National Red Cross whenever and wherever they are needed to support disaster relief operations.

The FCC has afforded special protection for this station. The license document for this system exempts the American National Red Cross from the requirements of §90.266(g). By reference, this in turn exempts the Red Cross from §90.35(c)(1) (eligibility) and §90.129(o) (requirement to submit communications plans).

The American Red Cross has 8000 mobile (MO) units on 47.42 MHz authorized under call sign KA3699. The authorized area of operation for this system is the Continental U.S. and possessions South of Line A and West of Line C.

The American Red Cross also has 2600 fixed base temporary (FBT) units on 47.42 MHz authorized under call sign KGB223. The authorized area of operation is U.S. Nationwide.

The American Red Cross has 393 other licenses for systems on 47.42 MHz. Each of these systems authorizes operation from a central fixed location. Some of these licenses also authorize a number of mobile stations.

BPL experiments were terminated in Austria after the Austrian Red Cross experienced massive disturbances from PLC during a disaster exercise in May, 2003. This is noted in Appendix B of NTIA Report 04-413.

Some government and military radio locations, frequencies, and bands are classified. It is unreasonable to require that government entities must compromise national security through disclosure of location, frequency or band information prior to installation of a BPL system to prevent potential problems, or disclose them after installation to mitigate actual problems.

Other government and military radio locations, frequencies and bands are not classified. However, the federal government has found it advisable to withhold information on non-classified frequencies.

The NTIA denied a Freedom of Information Act (FOIA) request for the non-classified Government Master Frequency (GMF) which was on file with the Interagency Radio Advisory Committee (IRAC). Although the request was for non-classified

information, it was felt that such a disclosure would also reveal. This determination was based on a determination that such disclose would also reveal classified listing by their exclusion from the unclassified list.

On April 2, 1982, President Ronald Reagan signed Executive Order 12356, "National Security Information". The enabling provisions of this order state:

> *"This Order prescribes a uniform system for classifying, declassifying, and safeguarding national security information. It recognizes that it is essential that the public be informed concerning the activities of its Government, but that the interests of the United States and its citizens require that certain information concerning the national defense and foreign relations be protected against unauthorized disclosure. Information may not be classified under this Order unless its disclosure reasonably could be expected to cause damage to the national security."*

The Federal Government later classified the GMF list under the authority of EO 12356.

As an authorized member of Air Force MARS (Military Affiliate Radio Service) this commenter has access to information which must remain Confidential. For purposes of illustration, I am attaching a copy of a redacted MARS Frequency List. I have deleted all entries which might allow anyone to identify or infer information related to call signs, frequencies, designators, transmission modes, or dates, times, names, and purposes of MARS networks. Once all of the redactions have been made, the only information remaining is the name of the document, and a warning to "never give out the frequency".

Operators of actual federal government and military stations would be operating under rules which are even more stringent than those applicable to the MARS program.

Many radio systems utilize Fixed Base Temporary, portable or mobile installations. On-line location information for stations licensed to operate under these classifications would be incomplete.

17. NTIA Recommendation 8.10, Installation and Equipment Registration

> *By centrally registering their current and planned BPL deployment details in a central, publicly accessible data base, BPL operators will have equipped local radio users with information they need to alert the BPL operator of potential interference problems. Such a registry could assist local radio users in diagnosing suspected interference, which in turn may preclude unfounded complaints of BPL interference. Furthermore, in the event of actual interference that is believed to originate from a BPL system, the radio users could consult the registry to determine the cognizant point of contact with the organization of the BPL operator. By keeping potential requirements for filing of an interference complaint with the FCC to a minimum, the registry would expedite elimination of actual interference should it occur and avoid the buildup of an unfavorable track record at the Commission. Unfavorable track records could precipitate further Inquiry and Rulemaking actions, that in actual fact, may be unnecessary. NTIA will further study and recommend the BPL deployment parameters that should be included in the registration.*

As noted above, electric utilities often fall short with respect to their current obligations to prevent harmful interference as described in §15.5, §15.13, and §15.15. The FCC Enforcement Bureau has had to send out numerous letters to various electric utilities advising them of their obligations under Part 15.

18. Claims Made by BPL Proponents

Claim: Some BPL proponents have claimed that there is no BPL interference (

Response: NTIA Report 04-413 conclusively demonstrates existing BPL interference and the potential for BPL interference.

Claim: It is not possible to protect short-wave broadcasts from interference

Response: ITU reciprocity requirements require the U.S. to protect spectrum used by foreign short-wave broadcasters

Claim: Techniques are available to mitigate BPL interference.

Response: Many of the techniques suggested by the NTIA are theoretical, and the NTIA plans future study and/or has requested additional work by BPL developers. As such, these techniques cannot be considered to be proven at this time.

Claim: Stations affected by BPL interference could use other frequencies

Response: No other frequencies are available0

Claim: BPL could bring broadband access to underserved rural areas

Response: BPL systems require repeaters to span long distances. These repeaters are typically spaced at distances on the order of one mile. The number of potential customers available in these sparsely-populated areas would drive the BPL operator's costs up to the point where they could not make back their investment. Furthermore, the NTIA has recommended increasing the number of repeaters and reducing the separation distance to reduce transmit power levels and the possibility for BPL interference.

19. Conclusion

As stated by the NTIA, the existing Part 15 limits may not be adequate to prevent harmful interference given that the BPL system would be in near-continuous operation, as opposed non-BPL devices which may have very short periods of operation.

The NTIA has documented actual and potential interference.

Many of the mitigation techniques proposed by the NTIA are unproven at this, time.

When taken together, these factors indicate that there are many unanswered questions which would pose risks affecting the technical and economic viability of BPL systems.

A high degree of uncertainty would affect BPL system operators, users, and investors. Unexpected costs related to interference prevention and resolution would directly affect the bottom line. In cases would interference could not be resolved the, the system operator would be required to discontinue operation.

The irreconcilable conflicts between existing licensed radio services and proposed access BPL systems would cause harmful interference to the radio services, and may also impair the operations of the BPL systems. The proposed implementation of BPL services would not be in the public interest, convenience and necessity, and the Commission should not proceed in this matter.

Respectfully submitted,

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