

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

In the Matter of)	
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INQUIRY REGARDING CARRIER CURRENT SYSTEMS, INCLUDING BROADBAND OVER POWER LINE SYSTEMS)	ET Docket No. 03-104
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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

Comments from:

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Introduction

The *Notice of Proposed Rulemaking* (NPRM) FCC 04-29 regarding carrier current systems that provide broadband access via powerlines, also known as BPL, adopted February 12, 2004 shows that the Commission does not have a clear understanding of BPL technology and has been distracted by the potential applications of BPL, most of which are available with existing broadband technologies. While one of the FCC's missions is to promote and encourage deployment of services beneficial to the public, it is the FCC's primary responsibility to protect existing licensed users of radio spectrum. The numerous *Notice of Inquiry* (NOI) filings presented a clear and concise case that the potential risks and dangers of BPL to licensed services was overwhelming and filings favoring BPL deployment lacked any notable technical evidence that interference would not occur.

I am dismayed that the Commission continually reassures the public that it is protecting licensed spectrum users, when in fact its actions show that it is clearly doing the opposite. The FCC did not wait for the pending NTIA study to be completed. The proposed "protection" for licensed users consisting of a database and adaptive technologies can hardly be considered protection, and is merely window dressing for a larger problem. Additionally, the NPRM suggests the FCC is moving cautiously. On the contrary, the FCC has granted most every wish of BPL proponents in this NPRM with the exception of relaxing Title 47 Part 15 emissions limits.

The Commission failed to address several key issues raised by over 5,000 NOI commenters. Some of these include:

- Numerous failed trials overseas and outright bans on BPL in some countries
- Point source radiation claims of BPL vendors which have been proven wrong by computer models
- Lack of any notable field measurements provided by BPL vendors and carriers conducting BPL field trials
- Simple empirical field measurements showing interference emanating from typical BPL installations
- Part 15 was never intended to support broadband signals radiated by distributed systems like BPL
- An alternative form of BPL using ISM or UNII band frequencies in development which avoids all the issues of low frequency BPL exists and is a viable replacement for problem-laden HF BPL
- The potential for the increase of the noise floor in HF spectrum
- Issues caused by bypassing transformers to pass BPL signals into the home
- The potential for ionospheric propagation of BPL signals causing long distance interference
- BPL test areas were not large enough to exhibit some potential issues
- BPL vendors and carriers conducting test beds provided only anecdotal evidence in the form of the lack of interference complaints to support claims of no interference

One wonders if any FCC personnel read the filings and seriously considered much of the material as the NPRM glosses over so many objections that have been raised. Adding to this blatantly apparent disregard of filed comments and a mountain of technical evidence, the nearly weekly rhetoric from FCC officials praising BPL puts into question the FCC's impartiality and objectivity.

Specific Responses

Page 13 of the NRPM states: "Because power lines reach virtually every home, school, and business in the United States, Access BPL technology could play an important role in providing high speed Internet and broadband services to rural and remote areas of the country. Thus, significant areas of the country still lack broadband access and many others lack competition for such services, and we believe that Access BPL could serve as a means to reach those areas. Since Access BPL uses the same power lines that carry electricity virtually everywhere, much of the infrastructure needed to operate this technology is already in place, so that major savings in deployment costs and capital may be realized in its deployment."

This paragraph illustrates the Commission's misguided notion, which is shared by much of the uninformed public, that BPL coverage will be easily ubiquitous due to the proliferation of power lines. Copper pairs for telephone service are equally

ubiquitous, but DSL coverage hardly comes close to being complete across the country. Ironically, BPL has less of an effective range than DSL and scales much less effectively than DSL or cable.

Other countries have surpassed the United States in broadband deployment using DSL, wireless, and cable. Meanwhile the U.S. is turning into the laughing stock of the world by promoting BPL technology which failed in other countries while continuing to allow established telecommunications providers to shirk their duties of providing broadband.

Page 15, Paragraph 34 states: "We believe that the current Part 15 levels will limit the harmful interference potential of Access BPL devices to relatively short distances around these devices." But it is easily proven using simple calculations that current Part 15 emissions levels do cause received signal levels in equipment that would be clearly considered interference. Also, Part 15 was never intended to allow large, distributed wideband signals. The Commission is horribly ambiguous with the phrase "relatively short distances". Most Radio Amateurs live within short distances of power lines, and considering the FCC glowing promotion of BPL, it is the dream and desire of the Commission to have BPL on every power line and within a short distance of all Americans. Thus based on the Commission's beliefs, harmful interference will be everywhere. But why should a wired network be permitted to pollute wireless spectrum, especially when no other viable broadband alternatives do?

Page 15, Paragraph 35 states: "We recognize that amateur operations are likely to present a difficult challenge in the deployment of Access BPL in cases where amateurs use high gain outdoor antennas that are located near power lines. In considering this interference potential, 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. Further, we note that many Access BPL technologies have the capability to avoid using specific frequencies, if necessary, to avoid interference. This would permit Access BPL devices to avoid the use of amateur frequencies when in close proximity to amateur outdoor antennas."

This paragraph is wrong on several levels and shows a blatant lack of understanding of power line interference and amateur stations. The interference currently experienced by amateurs (in non-BPL areas) is anomalous emissions from 60 hertz current, usually due to malfunctions caused by bad insulators, faulty connections, or other problems. These are most usually correctable with typical maintenance and most utilities today are aware of RFI caused by these problems.

Nearly all amateurs communicate with other stations in all directions, therefore omnidirectional capabilities are most always desired. But orienting antennas to avoid interference from power line anomalies is a futile effort and is certainly no a basis for BPL interference avoidance. Additionally, a 30 uv/meter signal at 30 meters, the emissions limit for HF frequencies under Part 15, in the vicinity of a typical HF antenna will produce a very strong S9 signal on a communications receiver. No practical HF antenna can be oriented to reduce such a signal to an acceptable level as it's likely that the interfering BPL signal will be within the near field of the antenna. In such an instance, the directional characteristics of the antenna receiving the interference are non-existent and of no help.

Most BPL systems do have the capability to avoid frequencies, but this does nothing to protect interference victims that are not in the locality of the interfering system. The Commission has failed to study the possible effects of HF propagation which could potentially propagate signals well beyond the local area which a BPL system operates. Tracking such long range interference down is nearly impossible.

Page 16, Paragraph 36 states: "We also disagree with ARRL and others that suggest that interference caused to amateur and other radio operations by Access BPL systems complying with our Part 15 limits will be widespread. Although we agree with ARRL that Access BPL on overhead lines is not a traditional point-source emitter, we do not believe that Access BPL devices will cause the power lines to act as countless miles of transmission lines all radiating RF energy along their full length."

This paragraph is unsupported and flies in the face of common electrical engineering knowledge. If BPL power lines are not traditional point-source emitters, then exactly how would the Commission classify them? While it's common sense that the strongest emissions will be at a BPL feedpoint, there are emissions, albeit reduced, further down the line. Considering that BPL repeaters are part of a typical BPL system architecture, there's RF energy on any portion of the line at some point, otherwise the system would lack network continuity between repeaters and would cease to function. The Commission's desire to "light up every outlet with Internet" will make BPL coverage widespread and hence the interference, so disagreeing with power lines acting as countless miles of antenna is a rather moot point.

Page 17, Paragraph 38 states: "We do not believe that this exemption would have any impact on interference potential since Access BPL would still be required to comply with our radiated emissions rules. We seek comment on these proposals. We further seek comment on whether Access BPL would in some instances operate in the AM broadcast band (from 535 to 1705 kHz), and whether specific conducted requirements are needed in such situations."

It's interesting that all BPL vendors that I'm aware of have specifically avoided the AM and FM broadcast bands. Why is it that the FCC seeks specific conducted requirements when AM broadcast band frequencies are involved? The rest of the NPRM seems to take the approach that all licensed services are protected by Part 15, regardless of the emission level and must stop operation in the event of harmful interference. Therefore, AM listeners have the same rights afforded to them as shortwave listeners, amateur operators, public safety agencies, etc. Why does this segment of affected spectrum users get preferential treatment?

Page 17, Paragraph 39 states: "Notwithstanding compliance with the Part 15 emission limits, we wish to emphasize that Access BPL would also operate under our Part 15 non-interference conditions. Thus, operations must cease if harmful interference to licensed services is caused. Given that there is significant investment in the deployment of the service, we agree with several commenters that Access BPL providers would have a strong incentive to exercise the utmost caution in installing their systems to avoid harmful interference and ensure uninterrupted service to their customers. In addition, given the typical attachment of BPL products to medium voltage lines and the possible use of BPL systems to control and monitor the electrical system, we believe that Access BPL systems likely will be managed on a more controlled basis as compared to other typical Part 15 operations."

This applies if the BPL system is experiencing ingress interference which is

disrupting its system, but not necessarily if the BPL system is interfering with a licensed service. There are no clear requirements for response times in resolving interference or ceasing operation. While most power companies have improved their RFI mitigation response in recent years, there are still ongoing power system RFI issues in some areas that have been open for years. It's likely that a BPL provider could easily delay ceasing operation for several months or a year, especially if an amateur station is involved in the complaint. It's unlikely that the FCC will be sufficiently staffed to address such complaints in a timely manner.

Another issue to contend with is how utilities "spin" such interference issues to its customers, especially if ceasing operation is the only option. It will be easier to blame amateur radio operators for the problem, when the underlying cause is poorly designed technology. I would think the FCC would not want to promote a technology with such a weak foundation and create a situation that puts the general public at odds with licensed services that provide (on the surface) less obvious value to the public.

Adaptive Technologies

The "adaptive interference mitigation techniques" described in the NPRM, while sounding high tech, are actually administrative functions that are present in most BPL equipment. These include:

- Power control, dynamic or remote
- Frequency notching
- Harmful interference shut-down feature

First off, these techniques do not provide any protection for mobile or portable stations. Does the Commission expect licensed portable stations to research ahead of time before traveling into an area to determine if an interference potential exists? Dynamic power control is an obvious no-brainer and should be a requirement. Frequency notching is another feature that should be required, but the question that bears asking is, *should sensitive frequencies be notched by default?* It's assumed that the FCC wants to allow BPL operators to notch frequencies based on interference complaints. It would make sense though to require frequency notching of specific bands by default such as these:

- Amateur Radio – presence in residential neighborhoods and portable and mobile operations which have difficulty clearing frequency bands ahead of time
- Public Safety – criticality of these services cannot be jeopardized under any circumstances
- Aeronautical – same as public safety
- Shortwave Broadcast – weak signal reception issues
- Radio Astronomy Frequencies – weak signal reception issues
- Maritime Frequencies – weak signals and public safety

It should be noted that default notched frequency bands should be revisable in the future as allocations change. BPL system operators should be required to comply with updated notching requirements within a specific time period.

The shutdown feature appears to be a euphemism for a remote control on/off switch. I'm not sure how this could be made an automatic feature as a BPL system would have no way to detect if a licensed service is experiencing interference. In this day and age, it is a basic administrative requirement that network elements be remotely manageable. It's a real stretch considering this an interference mitigation technique.

BPL System Database

In paragraph 43 of the NPRM: "Finally, we propose to subject Access BPL systems to a notification requirement similar to the notification requirements in our rules for power line carrier (PLC) systems. Under this requirement, an Access BPL system operator would submit information on its system to an industry-operated entity. The objective of the proposed notification would be to establish a publicly accessible database for Access BPL information to ensure that the location of Access BPL systems and their operating characteristics are identified if harmful interference occurs and to facilitate interference mitigation and avoidance measures. We propose that this notification includes information on the location of the installation, the type of modulation used and the frequency bands of operation. We seek input on these proposals. We also request comment and suggestions on the appropriate industry-operated entity that we should select to receive the notifications and maintain the Access BPL data base. We also seek comment on other approaches for making this information available. For example, would it more reasonable to allow each Access BPL operator to maintain a database of its own rather than require a more centralized data base?. Commenting parties are requested to submit information on the benefits of such approaches. We further seek input on any resulting burdens that the proposed notification requirement may place on entities operating Access BPL systems, and any impact of a notification system on the availability of customer data as well as how any concerns regarding the proprietary nature of that data can be addressed."

I agree that the database in general is a good idea, but it is far from a solution for interference. As with the adaptive interference mitigation techniques, a database does nothing to protect mobile and portable stations. The database should be administrated by an independent party not affiliated with a BPL vendor, carrier, or industry association. It would not make sense to have each BPL operator maintain their own database as this would require a party experiencing BPL interference to identify the company producing the interference and defeats one of the key purposes of a centralized database. Specific requirements for updates to the database so that its accuracy can be maintained and penalties for not keeping information accurate are needed.

But considering the importance the FCC places on this database, why should it be given to an entity outside the FCC? It is the FCC's responsibility to maintain databases of licensees so it seems logical that the FCC should maintain the BPL database as well.

On Air Identification

In addition to the database and “adaptive interference mitigation techniques” there absolutely needs to be some kind of on air identification to enable rapid and more exact identification of interfering signals, especially when dealing with ionosphere propagated signals. This identification should be easily received and decoded by a typical communications receiver. I recommend that Morse code identification be used, and BPL carriers be required to identify on a frequency within 50 kHz of the lower or upper limit of each band of emissions. If the emission exceeds a bandwidth of 4 MHz, multiple identification frequencies should be used not more than 4 MHz apart. The BPL service related emission should not obliterate the identification.

The identification should reference a Carrier ID number which would identify the company providing the service, and a System ID number which would identify the neighborhood or vicinity in which the system is operating. Both the Carrier ID and System ID numbers would be in the centralized database. BPL providers should also be required to post the Carrier ID and System ID number on poles or pedestal enclosures containing BPL equipment.

Considering that most if not all BPL equipment vendors are using DSP to generate BPL signals, it would be trivial and inexpensive to generate Morse code identification. Morse code is simple to receive and does not require expensive equipment.

The Part 15 “Safety Net”

Throughout the NPRM, there seems to be an underlying theme that regardless of what objections are raised, or whatever decisions the Commission makes regarding BPL, licensed services are protected by Part 15 and there's nothing to worry about. Taking Part 15 at face value and from an idealistic standpoint, this is true. In reality though, invoking the *no harmful interference* tenet of Part 15 can be tedious, time consuming, costly, and painful for licensees. There's no clear litmus test for what constitutes interference. There are no clear response time requirements for Part 15 users to resolve interference or cease operation. It's easily conceivable that interference complaints, especially from Amateur Radio operators, could drag on unresolved for months or years if power companies with a large base of installed customers and well funded legal teams challenge the validity of such complaints.

In the past, when licensed HF services encountered Part 15 interference, it was usually narrowband carriers emanating from unintentional radiators that could be avoided by shifting frequencies. This type of interference is tolerable and avoidable, and is within the original intent of Part 15. BPL though is a wideband signal that blankets large swaths of HF frequencies. It is unlikely that an HF operator experiencing interference can avoid such wide signals. It's likely that an entire allocated band would be unusable and the affected operator would have to pursue filing a complaint with the BPL provider.

The Commission is lackadaisical in its proposed management of HF spectrum in regards to BPL. It has been made acceptable to encourage wideband devices to radiate emissions over large chunks of frequencies and shift the responsibility to licensed services to manage the spectrum through interference complaints. I'm

disappointed the FCC hasn't realized that Part 15 as it is worded is outdated and ineffective for properly regulating wideband intentional radiators.

There has never been a wideband system using large swaths of HF frequencies in a carrier current type system – how can the Commission possibly consider Part 15 as it currently stands to sufficiently protect licensed users?

The situation that the Commission puts licensed users of HF spectrum in is tenuous. New Amateur Radio licensees can expect interference right off the bat if BPL systems are operating in their area. As we've seen with the test areas, if there are no Amateurs in the immediate area, BPL providers will use spectrum in Amateur bands. A new licensee will have to file a complaint with their local BPL provider to clear out Amateur bands so they can merely operate. This isn't a very appealing endeavor for people looking to join the Amateur Radio Service. Should Amateurs prepare now and modify the exam question pools so that new hams will know how to properly identify BPL interference? Should they be as well versed in Part 15 as Part 97? I say this partly in jest, but it is largely true and will be needed if the Commission continues to let BPL proceed in its current form.

Another scenario to consider is that of a Shortwave Listener (SWL). At the very least an SWL would want to have the shortwave broadcast bands interference-free to receive international signals. After filing complaints with the BPL provider, BPL emissions are moved to other bands. It is easily conceivable that emissions would then fall into an Amateur Radio band. Later, a new Amateur is licensed in the area, or an Amateur moves into the neighborhood. The Amateur experiences BPL interference and files a complaint, and the BPL provider responds by moving frequencies again, now potentially interfering with the SWL's reception. This is a simplified scenario, but understand the basic point – BPL carriers are going to be fighting a losing battle to keep all non-Part 15 spectrum users interference-free. This situation is exacerbated even more as the system bandwidth requirements grow, the system is further segmented in a cellular fashion, and more frequencies are required to serve these new segments. Each system will get to a point where all frequencies are in use from 1 to 30 MHz in a given neighborhood causing problems for licensees and the BPL carrier.

But considering the needs of SWLs further, a shortwave listener could conceivably demand spectrum from 1 to 30 MHz interference free. How could a BPL carrier deal with that? Or is the Commission going to deny the right of the public to enjoy shortwave listening?

In light of all the points above, I recommend that the Commission seriously re-evaluate the 30uV/m at 30 meters limit currently in place and adopt a much more stringent limit for BPL emissions to protect licensees, especially mobile and portable operators. This limit should be adjusted such that any HF operation within the vicinity of a power line will not receive any noticeable BPL signals in normal operation.

Commissioner Comments

Commissioner Adelstein stated "While we must be mindful of harmful interference, we cannot let unsupported claims stand in the way of such an innovation as BPL systems." He made this statement despite several computer models showing significant interference potential and field measurements clearly showing reception of interference. On the other hand, several carriers and vendors

conducting BPL trials filed comments that interference didn't exist as there were no complaints. It was obvious from the NOI comments filed by these parties that no HF and low band VHF measurements were taken, or if they were the companies were not making these measurements public. I find it amazing that a Commissioner can dismiss claims supported by computer models and field measurements with weak anecdotal evidence that doesn't hold any technical weight. Even more appalling is the fact that the FCC released this NPRM before a study from the NTIA was released.

Chairman Powell stated, "BPL could also improve the provision and management of electric power systems, enhance homeland security, and protect vital elements of our Nation's critical infrastructure." Why would anyone want to protect vital elements of our infrastructure with Part 15 unlicensed devices that are afforded no interference protection? This is a wide gaping hole that any terrorist organization could drive a truck through, pun intended. Ironically, *BPL actually weakens homeland security as it threatens to interfere with HF communications of licensed services that are specifically tasked with public safety.* It is unconscionable that the Commission would make such a statement.

Taking this further, the FCC denied an amateur LF allocation in 2002 due to power companies complaining that Part 15 PLC systems would be interfered with, thus threatening to disrupt power grids. Can we expect the FCC to order licensed services in HF bands to cease operation when Part 15 BPL devices that are "protecting vital elements of our Nation's critical infrastructure" are disrupted?

Regarding BPL's potential to improve the provision and management of electric power systems, utilities currently have several options available to them. Low frequency PLC has been in use for years providing telemetry and control. SCADA systems are also in use. There is plenty of spectrum in the ISM and UNII bands available that is suitable for high bandwidth applications. In regards to meter reading and on demand billing applications, there are systems that communicate within the 60 hertz signal currently present on the line. These work without any modifications to the power system as it was designed to carry such signals and work without interfering with HF systems. If utilities have not implemented full control and management of their power systems to date, it is not due to the lack of available communication equipment. BPL will not improve this situation.

Conclusion

Twenty years ago a proposed system such as BPL would likely have drawn laughter from any trained FCC engineer or experienced official. Currently the FCC is struggling with interference issues to public safety services on 800 Mhz, an ongoing problem lasting well over two years. This problem to my knowledge was largely unforeseen and the FCC has yet to provide a solution. Yet we appear to be heading straight for another interference fiasco.

BPL stands to end the ability to use HF spectrum anywhere in the country at any time in an *ad hoc* fashion. Portable and mobile operators will no longer be able to assume that HF spectrum is usable in a given area. Licensed HF users will be expected to clear out a spot in the BPL-induced "radio spectrum smog" by filing complaints with BPL providers, prompting them to notch out frequencies and adjust their systems. Does it make sense to pollute HF spectrum in order to prop up a technology that has been vaporware for six years, and has been rejected in several foreign countries? Will the legacy of this administration be pollution of HF bands and the end of HF communications as we know it? Should all licensed services be aware

that their historically trouble-free communications can be eroded by the next unlicensed Part 15 technology that catches the eye of the Commission?

Unfortunately, it will not be this administration's responsibility to clean up the resulting mess from widespread BPL deployment. Customers can expect inferior qualities of service and BPL carriers will be troubled by ingress interference issues and continual interference complaints. Licensed services normally accustomed to problem free operations will be plagued with interference issues and will have to exercise their rights under Title 47 frequently. Carriers struggling with solving impossible interference issues will likely have to shut down systems. Some will result to legal means and challenge the meaning of "harmful interference" while licensed services continue to suffer. Ultimately, investors in this technology will bear the financial brunt of the inaction to properly regulate BPL and the FCC's advocacy of this nonviable technology.

It seems to me that the FCC had no intention of truly considering the technical evidence against BPL that was presented during the NOI comment period and the goal was to fast track BPL technology at any cost regardless of the dangers, concerns or pending field studies. I feel the FCC simply did not do its homework and is looking for an easy political touchdown. It is my opinion the FCC's release of the NPRM was premature, and the NPRM comment period is likely an exercise in futility for those attempting to bring the FCC to its technical senses.

Considerably more research needs to be done on BPL, including extensive field studies. The FCC needs to look beyond the applications of BPL and the BPL equipment vendor and carrier press releases, and drop the role of a BPL advocate and resume its duties as a protector of licensees and the general public.

Respectfully submitted,

Anthony Good