

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

In the Matter of)
)
Amendment of Part 15 regarding new requirements) ET Docket 04-37
and measurement guidelines for Access Broadband)
over Power Line Systems)

**COMMENTS OF
Fred C. Jensen
30 April 2004**

CONTENTS

- I. BACKGROUND
- II. DISCUSSION OF NPRM
- III. COMMENTS ON NPRM APPENDIX B - PROPOSED RULES
- IV. CONCLUDING COMMENTS

I. BACKGROUND

I submit these comments to the subject NPRM as an individual, without benefit of legal counsel, and with no commercial interest in any form of broadband data delivery services.

I am retired from a career in communications, systems, and computer engineering. I hold a Bachelor of Science degree in Mathematics from California State Polytechnic University in San Luis Obispo, CA; and a Master of Science degree in Computer Science and Engineering from California State University, Sacramento. I served in the U.S. Air Force from 1962 to 1972 as a Communications Officer and Mathematician, including a year in Alaska, four years field experience in Vietnam and Laos, three years performing trajectory planning and guidance analysis for NASA during Project Apollo, and the remainder implementing airborne radar systems.

After leaving the USAF, I was employed as an engineer by several companies, primarily as a Project Engineer on communications systems (land mobile and terrestrial point-to-point), command and control systems (DoD), and supporting software systems.

I am an active amateur radio operator. I was first licensed in 1953 as KN6DGW at age 13, and subsequently upgraded to General (K6DGW) and then Amateur Extra in 1956. I have also held additional call signs of KL7ETK and WA5SNP. I am the trustee for the club license KI6TE for the Golden Sierra Amateur Radio Group. Except for the approximately four years while on active military duty in SE Asia (1964 -1967), I have been continuously active as an amateur. I have also held a Radiotelephone First Class license (now General Radiotelephone Certificate) since 1958.

II. DISCUSSION OF THE NPRM

To assist in summarization by the Commission staff, I will refer each comment to the paragraph number used in the NPRM using bold face type and square brackets (e.g. **[31]**). Where my comment applies to only a part of the numbered paragraph, the relevant portion of the paragraph will be quoted in italics prior to the comment.

I appreciate that the Commission's staff have given the issue of BPL deployment a great deal of attention and effort, and, based on the NPRM, I believe there is an earnest desire to deal with the significant interference potential of this technology and, at the same time, create a useful and well-reasoned path to investigate and employ it. I also appreciate the Commission's numerous questions and the opportunity to provide answers.

[31] *"... We believe that Access BPL systems can operate successfully under the non-interference requirements of the Part 15 rules. Under these rules, operators of Access BPL systems will be responsible for eliminating any harmful interference that may occur. ..."*

Until the advent of BPL, and with the exception of power line noise radiation, high frequency Part 15 devices have been few, and are for the most part, exhibit narrow-band emission characteristics with short duty cycles. Wide-band devices (e.g. cordless phones) have universally operated well into the VHF and UHF ranges. With Access BPL, we face a multitude of essentially continuous emitters across the entire HF spectrum. The issue is not so much whether Access BPL can operate "successfully" under Part 15 rules but rather is Part 15 sufficiently robust to deal with this new, broadband, continuous unintentional HF emission while preserving the non-interference principle.

"... Furthermore, we believe that the current Part 15 emission limits for carrier current systems in conjunction with certain additional requirements specific to Access BPL operations will be adequate to ensure that existing radio operations are protected against harmful interference from such operations."

CCS have, to date, been confined to the VLF and LF portions of the radio spectrum in the case of PLC systems, and the AM broadcast band in the case of campus radio stations (which are not relevant to this discussion). Wavelengths for these applications range from many hundreds to several thousands of meters. As a result, aerial power conductors are extremely close to the ground electrically, medium voltage

conductors are very closely spaced (electrically), and thus radiation efficiencies from the conductors are extraordinarily low. Access BPL, however, employs signaling in the HF spectrum. Dimensions of power line structures and their elevations approach or even exceed the wavelengths involved. Thus, radiation characteristics, measurement techniques, interference potential, and mitigation problems and opportunities are vastly different from traditional CCS.

[32] *"We propose to define Access BPL as a carrier current system operating on any electric power transmission lines owned, operated or controlled by an electrical power provider, as follows: Access Broadband over power line (Access BPL): A carrier current system that transmits radio frequency energy by conduction over electric power lines owned, operated, or controlled by an electric service provider. The electric power lines may be aerial (overhead) or underground. We request comment on this definition of Access BPL. Interested parties are invited to submit suggestions for alternative definitions. ..."*

Currently, 47 C.F.R § 15.3(f) defines Carrier Current Systems (CCS) as "A system, or part of a system, that transmits radio frequency energy by conduction over the electric power lines," and it further allows that such signals may be received by conduction or by radiation. 47 C.F.R § 15.3(t) defines Power Line Carrier (PLC) systems as, "An unintentional radiator employed as a carrier current system used by an electric power utility entity on transmission lines for protective relaying, telemetry, etc. for general supervision of the power system." It specifically excludes the lines "which connect the distribution substation to the customer or house wiring."

Thus, CCS is the generic definition of all systems which employ radio frequency energy transmitted by conduction, and PLC is one specific example of such a system. PLC systems operate in the VLF and LF range (9 - 490 KHz), on power lines at transmission voltages (>70KV) and are usually unintentional radiators. A second distinct CCS example is the Campus Radio Station, operating in the range 535 - 1705 KHz, usually operating on 120/230V customer service power lines as an intentional radiator. Note that both of these examples are narrow band applications of a CCS.

Access BPL is a new, distinct example of a CCS with its own very unique characteristics. It is an unintentional radiator operating in the MF, HF, and possibly low VHF range (~2 - 80 MHz), and unlike PLC and Campus Radio, it carries two-way high speed data, is exceedingly broadband by its very nature, and, except for customer terminal equipment, operates only on medium voltage "distribution" lines (typically about 12KV). The NPRM's definition ignores the fact that Access BPL has a well defined set of characteristics, including emissions from the conducted energy, that differ significantly from existing CCS..

I submit the following definition in lieu of the proposed definition to clearly delineate that Access BPL is an MF/HF Part 15 application:

"Access Broadband over power line (Access BPL): A carrier current system (CCS) that transmits radio frequency energy by conduction over electric power lines owned, operated or controlled by an electric service provider, using radio frequency energy in the range 2 - 80 MHz, for the purpose of two-way data transmission between customer premises and the Internet. Transmission is only via medium voltage (<13KV) distribution lines which may be either aerial or underground."

[33] *"... Accordingly, in order to better ensure protection of existing radio services, we are proposing to continue to apply the existing Part 15 emission limits for carrier current systems to Access BPL systems."*

I submit that the proposal to apply existing Part 15 emission limits for CCS to Access BPL is extremely unwise for the following reasons:

- (a) Notwithstanding all of the comments submitted in favor of BPL during the *Inquiry*,¹ there exists no compelling, repeatable experimental evidence that emission limits (and by extension, measurement guidelines to ensure compliance with them) which were designed specifically for PLC systems

¹ ET Docket 03-104

operating in the range 9 - 490 KHz will ensure that "the likelihood of such harmful interference is low" from BPL systems operating in the 2 - 80 MHz range.²

- (b) The Commission's proposal ignores the dramatic difference between PLC emission characteristics (narrow band) and Access BPL emission characteristics (extremely broad band).
- (c) If operational experience indicates that the existing Part 15 emission limits for CCS are not appropriate for Access BPL, it will be realistically impossible for the Commission to lower those emission limits. The BPL plant already deployed will represent a significant capital investment and subscriber base, and that equipment, having been designed to the current emission limits will likely not operate at the lower limits under all deployed conditions.

Indeed, the Commission's own language in the NPRM, "... we also *tentatively conclude that the likelihood of such harmful interference is low under the current limits ...*" [emphasis added] indicates uncertainty regarding appropriate emission limits. I submit that it is extraordinarily unwise for a Federal regulatory agency to take actions for which there exist no factual, repeatable data to show that the actions will ensure compliance with the requirements of the Communications Act of 1934 [as amended], and which may become irreversible if Access BPL is allowed to deploy under those possibly defective actions.

"... On balance, we believe that the benefits of Access BPL for bringing broadband services to the public are sufficiently important and significant as to outweigh the potential for increased harmful interference that may arise."

The benefits of Access BPL have yet to be established in a competitive marketplace. It is simply a technology that sounds good, and it may prove to have benefits. It could also turn out to be the economic equivalent of the 8-track audio tape. On the other hand, the issues of unintentional emissions and interference are a matter of physics. Unlike the "benefits" which cannot be predicted, the impact of the emissions of Access BPL can be calculated, modeled, and measured.

[34] *"While we appreciate the interference concerns raised by existing radio users, we note that Access BPL will operate in compliance with the current Part 15 rules that limit emissions from unlicensed carrier current systems to very low power levels in comparison to licensed radio operations. ..."*

The transmitted power level of desired HF station (possibly many thousands of kilometers distant) is irrelevant to this issue. All that matters is the received signal level versus the ambient noise and interference at the receiver input terminals, and HF communications systems often operate with very low signal-to-noise ratios. The interfering signals created by Access BPL mimic broadband noise and thus raise the effective noise floor in these receivers.

"... In this regard, we note that hundreds of kinds of unlicensed devices are successfully operating under the current Part 15 limits without causing harmful interference to licensed operations."

This is true, however Access BPL is quite unique among unlicensed Part 15 radiators in that its emissions are broad band, essentially continuous, and cover the entire HF spectrum. Conversely, the vast majority of existing unlicensed devices are narrow band radiators with severe duty cycle limitations imposed by Part 15.³

Furthermore, all unlicensed devices operating under Part 15 are subject to the condition that they not cause harmful interference and that they cease operation if they do cause such interference"

² See also NTIA Report 04-413, "Potential Interference From Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7 - 80 MHz," which provides strong engineering evidence that HF radiation characteristics from power lines is markedly different, and more intense, than from VLF and LF systems.

³ Consider 433.920 MHz, a frequency used by a multitude of remote temperature sensors and other unlicensed radiators. All are narrow band, and all transmit with very short duty cycles as mandated by the current Part 15 rules. The very short-duration pops, burps, and other noises one hears on this frequency are annoying, but can be dealt with in many circumstances. Such is not the case with continuous broadband noise.

Notwithstanding the requirement that Part 15 devices "are subject to the condition that they not cause harmful interference and that they cease operation if they do cause such interference," the burden of identifying the interference source, and obtaining compliance, particularly when the user of the device is a consumer, inevitably falls back upon the licensed service.

Although not as extensively commented on during the *Inquiry*, the reverse situation (Part 15 devices being required to accept interference from licensed services), while included in Part 15, is essentially impossible to enforce in a consumer environment. If my licensed operations disable or interfere with their Internet access, they will hold me to be at fault, even though I am not.

[35] *"We therefore would expect that, in practice, many amateurs already orient their antennas to minimize the reception of emissions from nearby electric power lines...."*

Amateurs, like all other communications users of the electromagnetic spectrum, orient their directional antennas in the direction of the station with which they wish to communicate. If that happens to minimize noise from power lines, or Access BPL, or other sources it is fortuitous, but not common. Further, the Commission's language in this section suggests that advising me to re-orient my antenna is a valid mitigation strategy for the Access BPL providers, which of course it is not.⁴

"... 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."

I ask the Commission to consider the following questions:

- (a) Will Access BPL providers be required to exclude amateur and other allocations? The NPRM does not now address this issue nor create any legal requirement for Access BPL providers to do so.
- (b) If Access BPL providers are not required to exclude licensed allocations as a general requirement, how will they accomplish what the Commission believes they can do? Clearly, if RF energy from a licensed service interferes with the Access BPL equipment, that equipment can be made intelligent enough to signal its distant transmitting device to exclude that frequency. This protects the local Access BPL device from interference, but does nothing to protect the licensed service from interference from the BPL device(s).
- (c) If a provider's equipment ceases use of a given frequency or frequency band because it detects RF energy in that band, is it permitted to return to that frequency band when the energy disappears (such as when the licensed user reverts to receive mode)?
- (d) How do the providers who assert this to be a mitigation strategy deal with persons just listening to a licensed service?

The NPRM is silent on these questions, and simply asserts that technologies exist or will exist, and will somehow be applied to eliminate the interference issues. Part 15 and the NPRM is also unclear on the issue of system ownership and who bears responsibility for the mitigating actions. Is my neighbor, a consumer of the BPL service, responsible to shut down his/her BPL terminal device if it creates interference, or is it part of the "Access BPL System," and thus the responsibility of the provider? If the terminal device was leased from the provider, it might be easy to answer that question. If my neighbor purchased it, it is not so easy, and I submit that the Commission make these distinctions a part of its regulations.

[36] As an individual, I am not equipped to conduct the studies necessary to define quantitative emission limits and measurement standards. However, I refer the Commission to the NTIA who are so equipped and who have conducted Phase 1 of a multi-phase study.⁵ That report is very clear that measurement

⁴ Part 15 notices in many consumer products, such as a television, already include the statement, "... reorient the antenna to minimize the interference."

⁵ NTIA Report 04-413 *ibid*.

techniques and standards tailored for HF wavelengths are a critical factor in the coexistence of Access BPL with existing licensed services.

[37] Regarding interference to public safety communications, I ask the Commission to note and consider that most on-the-air operators of public safety radio systems are not technically oriented, and will not be aware of, recognize, or understand the potential for interference and its effects. Identification of Access BPL interference will become the responsibility of each agency's communications officers and technical staff, and may saddle them with additional work and effort for which such local agencies are not funded.

"...For example, should we require Access BPL system to coordinate with public safety agencies that use the HF band for state-wide public safety communications? ..."

Most assuredly, "YES." Because the interference potential from Access BPL can be so invasive yet so unidentifiable, providers must be required to announce their intentions, technologies to be used, and geographic areas involved (in detail) to licensed users of that spectrum, and especially to public safety and service agencies.

Further, I ask that the Commission note that, in today's US economy, many of these local/municipal/state agencies are severely underfunded for their missions, and simply telling them what the provider may be planning to do will leave them with a challenge they cannot rise to and a burden they cannot carry. I therefore ask that the Commission take steps to place the burden of pre-deployment impact analysis on the Access BPL providers rather than on those agencies upon which they would inflict the interference.

[39] *"... 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..."*

As a citizen, I find this idea interesting, but naive. The United States is a capitalistic republic. Our fantastic 200+ year economy is driven by capitalism, and Access BPL will be no exception. Once a provider gets enough equipment installed and subscribers signed up, and assuming Access BPL proves to be economically viable, it will become a capitalistic force in itself. History tells us that capitalistic entities do not usually do the right thing, they usually do the profitable thing. We consider ourselves fortunate when the two goals happen to coincide.

[40] I agree with the Commission's requirements.

[41] *"...Ambient indicates that its equipment will be able to notch out individual frequencies "on the fly," in response to short term changes in the RF environment..." (emphasis added)*

Again, an equipment provider and Access BPL proponent argues that their equipment "can" perform some mitigation function. Unstated, however, is how it would operate and how it would protect licensed services operating in a particular frequency band, and, in fact, absent concise regulation, that they even would perform that mitigation. In fact, Ambient's statement speaks only to their ability to protect themselves from outside interference, not to eliminate interference they may cause to licensed services, as required under Part 15.

[42] *Second, we propose to require that Access BPL devices incorporate a shut-down feature that would deactivate units found to cause harmful interference, and thereby allow speedy implementation of interference mitigation measures. It is our understanding that most Access BPL devices already possess this capability..."*

The Commission's proposals to require adaptive interference mitigation and shut-down capabilities are positive and should definitely be a requirement. However, it is important to note that Access BPL providers are not invading virgin radio frequency territory with their unintentional emissions. There are a multitude of existing, licensed services and users already present, and it is thus quite reasonable for providers to be required to plan ahead to meet their well established Part 15 requirements, and publicize it.

The Commission can and should hold Access BPL Providers responsible for sound advanced planning of their installations to meet Part 15 requirements. This should include notification to all licensed users in an area of proposed deployment.⁶ The notification should include a detailed description of the proposed service area, frequency ranges that will be employed, power levels involved, relevant operational characteristics of the equipment, interference mitigation capabilities of that equipment, and contact information for the provider. I believe strongly that public safety/service agencies in the service area should each be directly contacted. Providers should be required to publicly disclose the geographic location of Access BPL equipment such as connections to the telecommunications network, routers, and repeater/extractor/injector sites.

"... We seek comment on these proposals and invite suggestions for alternative approaches. In particular, we request comment on whether we should have specific requirements regarding the above mitigation approaches ..."

I agree that the Commission's focus on mitigation strategies and shut-down capabilities is a positive and sound approach. I caution, however, that at this point, it is not very substantive. Exactly how will the providers determine which portions of the spectrum to avoid? Amateurs, for example, are allocated bands of frequencies, which are shared by all of us. If the mitigation strategy is, as Ambient proposes, to avoid those frequency ranges where providers encounter problems, how does that help the users of that allocated spectrum who might be trying to receive weak signals at that moment?

"... For example, should we require that each Access BPL device be capable of operating across a minimum range frequencies and have the capability to remotely exclude a specific percentage of frequencies within this range. ..."

In answer to the question, "No!" The two fundamental requirements of a Part 15 device are to create no interference to licensed users, and to accept all interference they might encounter. The Commission's example of requiring capability to exclude a percentage will fail to enforce those two requirements by placing an arbitrary limit on the percentage of frequencies excluded by the Access BPL providers. Once that arbitrary frequency exclusion limit has been reached, the provider(s) can reasonably argue that they have met their requirement under Part 15. I urge the Commission not to dilute the two basic Part 15 requirements, and to simply require exclusion of any frequency band for which interference to a licensed service occurs or could occur.

I ask that the Commission should require that all Amateur allocations in the relevant spectrum (2 - 80 MHz) be prohibited from usage by the Access BPL providers and all of the intermodulation products and harmonics thereof. How else but by specific regulatory action can the Commission ensure that Access BPL meets it's requirement to protect its licensed services, given Access BPL's broadband characteristics?

"...We seek comment on the appropriate period of time that we should allow for BPL systems to come into compliance with any new requirements that we may adopt pursuant to this rule making proceeding .."

Access BPL equipment deployed pursuant to and after the final action in this NPRM should be required to meet all requirements adopted by the Commission, prior to its deployment. The "appropriate period of time" in this case is *zero*, in that it makes no sense whatsoever to allow any deployment of non-compliant equipment and systems.

⁶ In my comments relating to NPRM §43, I suggest that the Access BPL "Database" discussed in the NPRM include the ability for licensed users in a proposed geographic deployment area to register their presence, thus alleviating the burden such notification would place on the Access BPL providers.

We further seek comment on whether Access BPL systems currently deployed should be required to be brought into compliance with the new rules, and if so, what period of time should be afforded for them to come into compliance."

These installations are (so far) small, and early compliance is relatively easy. In most cases, it would simply mean replacement of specific non-compliant equipment. Consequently, I suggest that a short period of time (60 - 90 days) following final adoption of this NPRM would be reasonable and not overly burdensome to providers. A longer period is an invitation to providers to delay or ignore the requirements, possibly forever.

Precedence in Time and Place (FITAP) Issues: While the NPRM is silent on the issue, the Commission must clearly recognize that mere deployment of an operational Access BPL system in a geographic area under the provisions of Part 15, does not, in any manner whatsoever, convey to that Access BPL system a waiver of the Part 15 non-interference provisions, simply because it was first in time and place. Any licensed user in any service within the HF spectrum takes precedence over the existing Access BPL system, regardless of the longevity of the Access BPL system prior to the arrival of the licensed user.⁷ The NPRM does not now recognize this requirement explicitly, and it must do so.

[43] The Commission's proposal for a central database is noteworthy, and, if properly constituted and maintained, can be a strong force for deployment of Access BPL while still meeting the requirements of Part 15. As with much else surrounding Access BPL however, it can only be a positive force if the Commission establishes the detailed legal requirements for it and takes the necessary regulatory and enforcement actions to ensure that those requirements are met.

To be effective, the database must have the following characteristics, content and capabilities, at a minimum:

- (a) It must be publicly available to all, with no charge for access.
- (b) Providers must be required to provide information regarding their planned deployments of Access BPL in advance of the actual installations. This information must include:
 - Geographic information defining the deployment area
 - Deployment schedules by area and sub-area
 - Equipment characteristics such as frequency bands to be used, modulation techniques, occupied bandwidth at each frequency band, locations of connections to the telecom network, spacing between devices, and customer termination arrangements.⁸
 - Provider telephone, USPS address, and Internet contact information.
- (c) A mechanism for licensed users to register their presence in the service area, and to provide information regarding frequency bands used.
- (d) A mechanism for licensed users of the Access BPL spectrum to submit interference complaints and track their resolution.

Regarding database access mechanisms:⁹ The fundamental requirement is that the information in the database be easily available at no cost to the public. Ease of access would argue in favor of a centralized

⁷ This issue is of grave concern to the amateur service since amateurs are individuals, licensed operations nearly always occur at residences, and individuals do relocate their residences frequently.

⁸ I ask the Commission to recognize that strong signals in adjacent frequency bands, *even if there are no emissions within the excluded frequency band*, can and do still create interference for a licensed users. This speaks again to the basic question of, "What is 'harmful' interference."

database with access via the Internet using currently available web browsers. This would provide a single, standardized user interface and a consistent data organization, and would reduce the burden of database maintenance on individual providers.

"...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 ..."

The only truly viable, effective mechanism is a single, centrally-maintained database with no-cost access to the public via the Internet. A centralized database provides a standardized design and user interface, a single point of public access using ubiquitous software, and eliminates duplication of effort on the part of the individual providers. It removes the burden of dealing with multiple databases, user interfaces, client software products, and access methods that would be shouldered by the public if every provider fielded its own unique design. Of course, it also simplifies the burden on the Access BPL providers to have a single repository with standardized input and access requirements. Finally, in the longer term, a centralized database assists the Commission in matters of enforcement by facilitating analyses of cases of interference from/to Access BPL across the entire range of providers, geographic areas, and equipment/system configurations.

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.

The proposed notification requirement is absolutely essential to ensure that the provisions of Part 15 (and in particular the fundamental requirement that Part 15 devices may not interfere, and must accept all interference) can be enforceable. Access BPL providers must already assemble the information listed above in the normal course of business and system engineering. All the NPRM would be requiring is disclosure of that information through a central point -- a very small burden indeed. Likewise, providers are already required to have mechanisms in place to accept, track, deal with, and resolve interference complaints. Again, the NPRM would be requiring only that they perform these tasks publicly ... again, a very small burden.

Regarding proprietary information: In the absence of clear regulatory requirements, all businesses will argue that everything is proprietary and/or a trade secret. However, providers of Access BPL are encroaching into the HF spectrum, and the list of information items which should be part of the proposed database that I outlined above in this section cannot, by any stretch of reasoning, be termed proprietary. Consider, for example, modulation characteristics: The modulation scheme(s) to be used have an obvious and profound impact on the potential for interference from the Access BPL emissions. How that modulation is actually accomplished within the equipment can rightfully be declared proprietary information, and in fact, is of little concern to the public. However, the ultimate characteristics of the unintentional emissions impacts the public spectrum and is thus cannot be proprietary. Likewise, a provider's internal technical design of mechanisms to provide on-the-fly and remotely-controlled interference mitigation can rightly be classed as proprietary information. However these mechanisms, when employed in an operational system, have operational characteristics that impact the public spectrum, and thus again, those operational characteristics cannot possibly be classed as proprietary. Like the modulation characteristics, the provider will have literally broadcast them freely every time they are employed.

⁹ An issue not explicitly recognized by the NPRM, and apparently the Commission also, is that so-called "spread spectrum" systems have interference characteristics markedly different from orthogonal frequency division multiplexing techniques. One major difference, of course, is that for many spread-spectrum methods, the concept of excluding emissions from one or more frequency bands is not physically realizable. Another difference is that the emission levels can vary depending on system usage, leading to the situation where interference occurs at varying times, but cannot be repeated at will at any time.

Equipment Authorization and Measurement Guidelines

[44] I agree with the Commission's tentative proposal that existing Part 15 equipment authorization procedures for unintentional radiators can be applied to Access BPL equipment, however, I strongly believe that the Commission must specifically state that all such equipment specifications are ultimately subject to, and secondary to, the Part 15 "no interference" rule.

Access BPL Measurement Guidelines

[45] *"... Because Access BPL is a new implementation of carrier current techniques, as discussed, supra, there are no existing measurement guidelines for this type of equipment ..."*

I strongly agree with the Commission's point that Access BPL is a new implementation of carrier current techniques. In fact, it is for that reason that I believe the definition at NPRM §32 is deficient, and why I have proposed a more detailed definition that clearly indicates use of the MF/HF spectrum and for broadband data transmission.

"...We tentatively propose that Access BPL systems, including all BPL electronic devices, e.g., couplers, injectors, extractors, repeaters, boosters, concentrators installed on the electric utility overhead or underground medium voltage lines etc., be measured in-situ to demonstrate compliance with our Part 15 rules, at a minimum of three overhead and three underground representative locations, using the measurement guidelines in Appendix C ..."

I strongly agree that all measurements must be made in-situ. At medium and high frequencies, two apparently identical or nearly identical Access BPL configurations can exhibit markedly different emission characteristics, depending on ground characteristics, objects in the environment, and adjacent conductors.

"...For Access BPL installed on overhead lines, in order to take into account the effect of the long power line associated with the Access BPL equipment, our proposed guidelines specify measurements at fixed horizontal distances from the power line where the Access BPL source is installed. Thus, rather than finding the maximum emissions across a number of radials, - as currently performed for other Part 15 emitters - the receive antenna is moved down-line, parallel to the power line, starting from the Access BPL equipment location, to find the maximum emissions. Down-line distances used in this sequence of measurements are specified in terms of wavelength of the Access BPL mid-band frequency. We seek comment on these guidelines."

From a theoretical perspective, the Commission's recognition that Access BPL devices have clearly non-point-source characteristics is correct and reassuring. Numerous commenters to the *Inquiry* have pointed this out, and the NTIA Phase 1 Report confirms it quantitatively.¹⁰ And, again from a theoretical perspective, the use of wavelength as the distance unit of measurement helps solve the problem raised by the incredibly wide bandwidth occupied by Access BPL applications.

[46] *"In addition, we specifically solicit comments on the height of receive antennas used for radiated emissions measurements for Access BPL systems operating on overhead power lines and on the possible use of correction factors to account for antenna height. The proposed guidelines in Appendix C recommend a fixed loop antenna height at 1 meter and scanning the height of electric field sensing antennas from 1 to 4 meters. While these recommendations correspond to standard practice for other types of devices (especially when measured on a test site), these heights may not capture the maximum emissions from an overhead power line ..."*

¹⁰ NTIA Report 04-413 (*ibid.*)

Measurement techniques and standards defined for VLF and LF PLC systems are not directly applicable to standards and techniques suitable for HF systems. For VLF/LF CCS, wavelengths can range into the multiple kilometer range, and conductor heights (even on EHV transmission lines) are electrically very close to the ground. On the other hand, wavelengths for the HF emissions of Access BPL are in the 5 to 150 meter range, and for a large percentage of this range (> 7 MHz or so), typical aerial distribution lines at 45' are approaching or well exceeding 1/4 wavelength in height. Above about 22 MHz, they are one wavelength or more in height.

Because of the electrical height of the Access BPL emitting "antennas", in-situ measurements of aerial distribution lines are mandatory, and should be made with the measurement antenna at heights above ground that approximate the heights of the power conductors.

"... We seek comment on the following:"

(a) *Is it necessary to require that emission measurements be conducted at antenna heights greater than those proposed in Appendix C?*

All measurements of Access BPL emissions from aerial distribution lines should be made at heights comparable to the heights of the conductors or above. Typical aerial distribution lines at 12 - 15 meters height (40 - 50 feet) are comparable to the typical heights of HF antennas used by licensed services, and it has been shown conclusively in numerous comments to the *Inquiry* that power lines exhibit very complex radiation patterns at MF and HF frequencies.

(b) *Is it practical and safe to make in-situ emission measurements at antenna heights up to the height of an overhead medium voltage power line (typically 11 meters) when operating 10 meters from the power line? As an alternative to requiring higher antenna heights, should we specify that measurements that are performed at heights significantly lower than the power line be subjected to a correction factor to estimate the maximum field strength that would have been observed at a higher measurement height? How should such a correction factor be determined?*

There is no doubt whatsoever that it is practical ... after all, power utilities have bucket trucks and other equipment that can, by definition, reach their power lines. Indeed, there would be no need for a person to occupy the bucket during field strength measurements, and, in fact, it would be detrimental to the measurement accuracy to have a person that close to the measurement antenna.

I must defer to OSHA and other standards agencies and regulations regarding the matter of safety, other than to say that "the power guys fix their stuff all the time" so we all need to keep a sense of reality here! I ask the Commission to consider that: If it is necessary to modify the distance standards for reasons of safety, modifying the horizontal distance with a requirement for measurements at power line conductor height, is far more accurate and supportive of Part 15 requirements than allowing measurements close to the ground.

[47] The current absence of established national and international standards discussed in this section of the NPRM serves to underscore the tenuous nature of the Access BPL regulatory process. Indeed, the Commission uses the word "tentative" in this section and at several other places in the NPRM, clearly because the Commission recognizes that there are a number of unknowns for this new technology. While "perfect knowledge before action" is a worthy goal, I admit that there are times when the Commission must proceed, but proceed with caution and in small, reversible steps. As before, I strongly caution that wholesale deployment of Access BPL in a climate of less than complete knowledge has a very high probability of rendering the "tentative" actions and conclusions of the Commission irreversible.

III. COMMENTS ON NPRM APPENDIX B - PROPOSED RULES

28 I request that the Commission make the additions, deletions, and/or changes to the NPRM Appendix B that are shown below (proposed additions to existing text of the NPRM text are underlined):

§15.3 Definitions.

~~(ff) Access Broadband over power line (Access BPL): A carrier current system that transmits radio frequency energy by conduction over electric power lines owned, operated, or controlled by an electric service provider. The electric power lines may be aerial (overhead) or underground.~~

Access Broadband over power line (Access BPL): A carrier current system (CCS) that transmits radio frequency energy by conduction over electric power lines owned, operated or controlled by an electric service provider, using radio frequency energy in the range 2 - 80 MHz, for the purpose of two-way data transmission between customer premises and the Internet. Transmission is only via medium voltage (<13KV) distribution lines which may be either aerial or underground."¹¹

3. Section 15.107 is proposed to be amended by adding paragraph (e) to read as follows:

(e) The limits shown in paragraphs (a) and (b) of this section shall not apply to Access BPL systems with regard to conducted emissions on medium voltage power lines. However, the limits shall continue to apply to conducted emissions onto the low-voltage (< 240V) AC circuits supplying power to Access BPL devices.

4. Section 15.109 is proposed to be amended by modifying paragraph (e); adding paragraphs (f) and (g); and re-designating paragraphs (f), (g) and (h) as (h), (i) and (j), to read as follows:

Section 15.109 Radiated emission limits.

(e) Subject to future amendment as operational experience is acquired, c~~Carrier current systems, including BPL systems, used as unintentional radiators or other unintentional radiators that are designed to conduct their radio frequency emissions via connecting wires or cables and that operate in the frequency range of 9 kHz to 30 MHz, including devices that deliver the radio frequency energy to transducers, such as ultrasonic devices not covered under Part 18 of this Chapter, shall comply with the radiated emission limits for intentional radiators provided in Section 15.209 for the frequency range of 9 kHz to 30 MHz. As an alternative, carrier current systems used as unintentional radiators and operating in the frequency range of 525 kHz to 1705 kHz may comply with the radiated emission limits provided in Section 15.221(a). At frequencies above 30 MHz, the limits in paragraph (a), (b) or (i) of this Section, as appropriate, continue to apply. For all BPL systems, the requirements of this paragraph and paragraph (a) of this section shall also apply to the emissions from all low-voltage lines from the distribution transformer to all in-building wiring.~~

(f) Access BPL systems shall incorporate adaptive interference mitigation techniques such as dynamic or remote reduction in power and remote or pre-programmed adjustment in operating frequencies (and if necessary, frequency bands), in order for Access BPL installations to avoid site-specific, localized use of the same spectrum by fundamental, harmonic, and sideband products by licensed services. Access BPL systems shall incorporate a shut-down feature to deactivate units found to cause harmful interference. Access BPL provider entities shall investigate all interference complaints, and shall activate such mitigation and shut-down techniques/features within 24 hours of receipt of such complaint. All equipment which is an operational part of the Access BPL providers' system to deliver broadband Internet services to consumers shall be considered the responsibility of the provider, regardless of equipment ownership.

¹¹ See comments at NPRM §32

(g)) Entities operating Access Broadband over Power Line systems shall supply to a Federal Communications Commission/National Telecommunications and Information Administration recognized industry-operated entity, information on all existing, changes to existing and proposed Access BPL systems for inclusion in a data base. Such information shall include the installation locations for all equipment, deployment schedules by area, frequency bands of operation, ~~and~~ type of modulation used, bandwidth of emissions in all frequency bands, and customer termination arrangements. Additionally, the information supplied shall include identification of the entity including address, contact telephone number, and Internet contact information. The information shall be published on the Internet in a commonly-used format accessible to commonly-used Internet browser software, and shall include a mechanism for licensed users to register their presence in the service area and the frequency bands they employ. The Internet system shall further provide a mechanism for the public to submit interference complaints and to track their resolution. Access to the information via the Internet shall be at no cost to the public, and shall be unlimited. No notification to the FCC is required.

CONCLUDING COMMENTS

Despite the specific exceptions I have addressed in my comments, I applaud the Commission's reasoned efforts to craft regulations for an, as yet, untested technology. Access BPL may evolve to be a valuable and economically viable national asset that can coexist with licensed users in the same spectrum spaces -- we just don't know at this point. I will summarize the basic premise of my comments and recommended changes as follows:

- Access BPL has yet to be believably tested in the general presence of licensed users of the HF spectrum. Indeed, the comments to the *Inquiry*, and the NPRM summaries are filled with words like "tentative," "beliefs," and unsubstantiated assertions. Once deployed, with capital plant worth millions, and a subscriber base potentially worth many more millions, the Commission will find it difficult if not impossible to correct interference problems that may arise when the true operational facts are known. Access BPL has been abandoned in other countries, and we have no reason to believe that we in the United States are somehow exempt from the laws of physics that prompted that abandonment. For the Commission to take essentially irreversible regulatory actions is unwise.
- Access BPL employs the HF spectrum while traditional PLC CCS have employed a vastly different spectrum of electromagnetic radiation. A blanket application of the VLF/LF emission limits and measurement guidelines to a totally different portion of the spectrum is not warranted as a final solution ... but, referring to the point just above, while the Commission may not intend it as a *final* solution, it very well may turn out to be exactly that.
- We (thankfully) live in a capitalistic republic of unprecedented value, freedom, and quality of life. I, and most other citizens of this Republic, count on the Commission to ensure that the communications infrastructure is competently regulated to the benefit of all of us. Access BPL has the potential for regional and even national value but it is equally fraught with potential risks. I, in my FCC licensed service, also have regional and national value, and I look to the Commission to recognize and protect that too. If the Commission does not *require* actions of commercial, profit-motivated entities to accomplish that, those entities will opt for the profit first. Please don't misunderstand me ... profit is a good thing in a capitalistic republic. It's why we are who we are. But it is the Commission's task under the law to regulate this without endangering already present services, and I'm counting on that happening.
- And, to the Commission, please keep the public service agencies ... local, county, state, and national ... in your crosshairs for protection. They are struggling with enough, at a time when we can ill afford that.