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
Reply Comments to Notice of Proposed Rule Making (04-37)

Reply Comments by to the Notice of Proposed Rulemaking
by Benjamin S. Gelb

Listed are various excerpts from the FCC NPRM 04-37 along with comments to each of them.

Interference Potential

From paragraph 20, "[BPL companies] note that there have been no complaints of interference from BPL and that the existing Part 15 rules adequately protect incumbent spectrum users."

Given the fact that access BPL systems have been online only in very small trial installations, it is not surprising that BPL has not generated a great deal of interference complaints. This in and of itself does not give any weight to the assertion that access BPL will not be a source of harmful interference.

Incidentally, since the time of the release of the NPRM, at least one formal interference complaint has been filed.[1]

From paragraph 34, "In this regard, we note that hundreds of unlicensed devices are successfully operating under the current Part 15 limits without causing harmful interference to licensed operations."

[1] E. Alan Crosswell. "Harmful interference from experimental license WD2XEQ." http://www.columbia.edu/~alan/bpl/complaint-fcc.pdf.

Because some devices may successfully operate under Part 15 does not imply that other, different devices may experience the same result. There is no correlation.

Power Line Radiation

From paragraph 22, "Southern states that there is a high degree of variability in the ability of power lines to radiate BPL signals and that signals will tend to cancel each other out."

Southern is correct in asserting the high degree of variability of power lines as RF transmission line. Power lines were not designed to carry RF, and therefore have totally unpredictable RF characteristics.

Southern provides no basis for its statement that signals will "tend to cancel". Signals will cancel in properly matched balanced feed line where the current is equal and opposite in the two conductors and there are no standing waves. Per the assertion in the first part of Southern's statement, this is not the case. RF characteristics of power lines are highly variable and irregular.

From paragraph 22, "[Southern] states argues that its research to date would suggest that a BPL signal injection point can appear like a point-source radiator, with the power line having characteristics somewhere between a waveguide and an antenna."

A waveguide is a type of transmission line which confines electromagnetic energy inside of a hollow metal conductor at ground potential. An antenna is an intentional radiator which has the goal of radiating with 100% efficiency. Saying that the characteristics of a power line are "somewhere between a waveguide and an antenna" is equivalent to saying that the power line radiates somewhere between 0 and 100 percent of the power it receives. This should not have taken a great deal of evaluation to determine. It is quite difficult to imagine any case for which this would not be true. Southern's "research" should be met with a great deal of scrutiny.

From paragraph 23, "AEC asserts that because of impedance mismatch in real-world power lines, a single power line is expected to be a rather inefficient radiator."

The question is not how efficiently a power line will radiate, but whether or not it will radiate, and whether or not this radiation will cause harmful interference. Stating that the power line will be an "inefficient" radiator does nothing to answer this key question.

In any case, it is certain that power lines radiation will meet the maximum allowed under Part 15. If BPL companies did not expect the radiation to meet this level, they would not have asked for the maximum to be increase by stating that "higher emission limits are warranted" as is said in paragraph 20.

Incidentally, inefficient radiators can still make very effective antennas. To illustrate this fact, author Tom Schiller published an article[2] in QST magazine in July 2000 where he used a common incandescent light bulb as an antenna and was able to contact ham radio stations across the globe.

From paragraph 36, "…we do not believe that Access BPL will cause the power lines to act as countless miles of transmission lines all radiating RF energy along their full length. Rather the primary source of emissions will be the individual couplers."

The FCC has provided no basis to support this "belief" other than information from BPL companies. Given these companies vested interest in their products, it should be examined with a critical eye. Mathematical modeling, and more importantly, real world measurement[3] at BPL test sites contradict the FCC's "belief".

Interference Mitigation

From paragraph 26, "Ambient Corporation states that it is possible to avoid interference to nearby transceivers using the inherent frequency agile characteristics of advanced Orthagonal Frequency Division Multiplexing (OFDM) technology. Ambient states that if a sub-band is being used by a nearby transceiver, the BPL modem transmitter can be programmed to avoid transmitting on that sub-band or "notch" it out."

Notice Ambient's careful selection of the word *transceiver.* In order for interference to be mitigated, the licensed user must *transmit* before the BPL device will clear the frequency for a period of time. When the user stops transmitting the BPL device may begin to use said frequency or sub-band again. Should a licensed radio operator be trying to *receive* a weak signal, this "solution" provides no remedy.

The frequency agile characteristics of OFDM are really a mechanism to mitigate interference to the BPL system, not to other licensed radio operations.

From paragraph 35, "In considering this interference potential, we note that ARRL acknowledges that noise from power lines, absent any BPL signals, already presents a significant problem for amateur communications. We therefore expect that, in practice, many amateur already orient their antennas to minimize the reception of emissions from nearby electric power lines."

While the FCC's line of reasoning is creative, it is both flawed and illogical. The ARRL highlighted the magnitude of interference from power lines to illustrate the power industry's poor record regarding RF interference. Using power companies' inability to

[2] "Everything Works." QST Magazine. July 2000. pp. 47.
[3] ARRL BPL Video, http://216.167.96.120/BPL_Trial-web.mpg.

prevent RF interference from its current systems as a basis for allowing the emission of additional interference makes positively no sense.

Additionally, ham radio operators orient their antennas according to physical constraints, such as lot size and antenna covenants and restrictions, and if they should have the luxury of having a directional antenna system, the direction of the stations with which they are trying to communicate, not local noise sources. The FCC's statement in paragraph 35 roughly equates to saying that licensed operators are only protected from harmful interference if their antennas are directed away from the noise source. This, again, is utter nonsense.

Rural Service

From paragraph 12 "Current Technologies states that technical and economic considerations limit the deployment of cable and DSL. It submits that Access BPL is not constrained by these considerations and can deliver 'broadband to many of those unserved by other broadband technologies' and 'bring the advantages of the Internet to the people who need them most.'"

Current Technologies' assertion is wholly untrue. Access BPL will not provide service to rural areas for the same reasons that cable and DSL are not available in rural areas. As is stated in paragraph 3, access BPL is a means of "'last mile' delivery." A BPL signal can only travel a few thousand feet down a power line. Neighborhood distribution lines still must be connected to the Internet via fiber optic cable, as is outlined in paragraph 4. This is viable in an urban or suburban setting, where the number of potential customers can justify the fiber backhaul, but will not float in a rural environment.

The Commission seems to subscribe to a misconception that the national power grid can be magically connected to BPL and turn every outlet in America into an Internet connection. This is not the case. A substantial amount of new infrastructure must be constructed in the area of BPL service, and therefore will not promote BPL in rural areas any more than other broadband technologies.

Homeland Security

From paragraph 30, "Access BPL may allow electric utilities to improve the safety and efficiency of the electric power distribution system and also further our national homeland security by protecting this vital element of U.S. critical infrastructure."

The FCC provides no evidence to support its claim that Access BPL will enhance the security of our power distribution system. Given the apparent susceptibility of BPL to RF interference from nearby transmitters, as demonstrated by AMRAD[4], it seems it would be tremendously simple to disrupt and may actually weaken homeland security.

[4] Additional Reply Comments by AMRAD to NOI 03-104.

It is also conceivable that using the same network to both control the power grid as well as deliver Internet connectivity to the masses may be a poor choice from a security standpoint. This could potentially provide a way for cyber-terrorists to gain access to the power system.

It would appear that homeland security is mentioned for the sole reason that many politicians and citizens have some sort of emotional attachment to it. In the current era of post-9/11 paranoia we live in, questioning anything respecting homeland security is often viewed as unpatriotic. It seems that BPL itself really has little, if anything, to do with homeland security.

Certain licensed services, such as FEMA and amateur radio, which stand to be affected by harmful interference from access BPL systems, do provide a valuable homeland security function. Ham radio operators have assisted during countless emergencies, including hurricanes, wildfires, and the 9/11 attacks on the United States.

BPL Operational Requirements

I appreciate the emphasis placed on Part 15 non-interference conditions by the Commission in paragraph 39. I also agree with the requirements outlined in paragraphs 40, though I believe they need to be more specific in several cases.

The capabilities for interference mitigation outlined in 40 through 42 are indeed crucial to controlling interference to licensed services. When and how would such capabilities be applied? I suggest the creation of some sort of 24-hour call center for handling interference complaints. BPL operators can, in real-time, reconfigure the BPL system to mitigate interference.

Should remote operators be unable to isolate and resolve the problem, specialists must be sent to the site of the interference to investigate and isolate the problem.

If this process must be repeated more than a certain number of times (perhaps 3), all BPL operations must be shut down pending FCC evaluation. The FCC must remember that the burden of resolving interference complaints rests on the unlicensed user (BPL) and not licensed spectrum users.

The database of BPL equipment outlined in paragraph 43 must be maintained in near-real time and accessible via the Internet. How will the FCC ensure that such a database is both up to date and accurate, given that it will be costly for BPL providers to maintain, and does not serve their economic interests?

I suggest that the database be made available via the Internet for easy public access. The database will only serve its purpose if it is easy to obtain access to.

The proprietary nature of BPL systems must not be used as an excuse to withhold operational characteristics of a system that may play into its interference potential.

In addition, research into the viability of over-the-air identification of BPL systems should be conducted. The idea of embedding a CW or voice signal carrying identification of the BPL device at certain frequencies within the BPL signal. These beacon frequencies should also be included in the BPL equipment database.

Ultimately, how does the FCC plan to address disputes between BPL providers and licensed spectrum users receiving harmful interference? Given the economic interest riding on the successful operation of its BPL system, it is not inconceivable that BPL providers may choose to ignore or dispute interference complaints. Power companies are generally uncooperative in resolving interference complaints from their conventional power systems, given the number of FCC notices sent to power companies by Riley Hollingsworth. The FCC must find a method to compel power companies to be very responsive resolving complaints with BPL systems. The burden of resolving interference issues must rest on the unlicensed user.

BPL installations should also be subject to ongoing evaluation by the FCC to ensure compliance with Part 15.

Measurement Guidelines

I agree with the necessity for *in-situ* testing. Real-world testing is the only testing which really matters, and given the unpredictable nature of the RF characteristics of power systems, it is the only type of measurement which can be assuredly accurate.

I disagree with the proposal that measurements be based on the "mid-band frequency" of the BPL signal, as is suggested in paragraph 45. There is no reason to think that the greatest signal strength will conveniently occur at the mid-band frequency. Given the unpredictable variability in the RF characteristics of power systems, the maximum could occur anywhere within the BPL signal's bandwidth. Measurements should be taken at many different, random intervals down the power line as well as at all impedance discontinuities such as power taps or splices, or transformers.

Because of the variable nature of power systems, measurements must be taken throughout a BPL installation, not just a three specific points within it.

Additional Comments

It is difficult to understand how the FCC can implement intelligent and effective policy regarding BPL when so little real-world evaluation has been conducted and so little factual information is available. The statements of the FCC regulators in conjunction with this NPRM seem incredibly naïve.

For example, what is the power level injected by BPL transmitters into a power line? How can policy be crafted when technical details as simple as these are unavailable? The Commission is putting far too much faith in the promoters of BPL technology and basing

its decisions on “beliefs” that are not supported by any factual, technically sound arguments, only by the marketing gospel of the BPL industry and wishful thinking.

I urge the commission to conduct further real-world testing before proceeding with its rulemaking to better assess the interference potential of access BPL systems.

I also wish to suggest that better alternatives, such as encouraging power companies to use their right-of-way as a conduit for fiber optic cable, then use wireless connectivity for the last mile. With proven wireless standards such as 802.11b, as well as the up coming 802.16 WiMax technology, which promises wireless connectivity over distances of 30 miles, this seems a very viable option. It also does not have any of the interference concerns that BPL does.

Finally, I wish to thank the Commission for considering my comments.

Respectfully submitted,
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