Greetings,
My name is Michelle Thompson. I hold an MSEE in Communication Theory and have 5 years experience in the wireless communications industry. These are my comments concerning the Inquiry Regarding Carrier Current Systems, including Broadband over Power Line Systems (Docket 03-104).

In order to transfer high frequency signals beyond the low-voltage distribution transformer, Access BPL systems use high-pass filter circuits to bypass the transformer and its inherent low-bandwidth characteristics. What is the effect of these high-pass filters with respect to high-frequency signals used inside the house, *e.g.*, from In-House BPL equipment or other in-premises technologies, that may rely on the low-voltage transformer as a natural barrier to avoid causing interference at higher frequencies?

The primary functions of a transformer are voltage transformation and isolation. If the isolation function of a transformer is going to be removed by the addition of a high-pass filter circuit, then the potential for harmful interference in both directions is greatly increased.

Is there a need to define frequency bands that must be avoided in order to protect the licensed users on the same frequencies as those used by Access BPL systems?

Not only is there a need to avoid the specific bands that are used by licensed users, but the definition of what frequencies must be avoided has to include what would potentially be generated by nonlinear effects of the power lines. Power lines are not a good environment for high-frequency data, so there are significant concerns regarding the quality and predictability of high-frequency data signals on power lines. Since consistency of product is always a concern in business, the use of power lines to transmit data would seem to be a dubious choice due to the extreme variance in types, age, limitations and maintenance of various lines.

Are there mitigation techniques Access BPL systems can use to avoid possible interference with licensed users of the spectrum, such as mobile users or public safety and law enforcement users who may be traveling directly beneath the medium voltage lines?

Well, restricting Access BPL systems from generating as well as receiving harmful interference on frequencies that are used by licensed users of the spectrum would be a bare minimum. That would seem to be quite the task, considering that medium-voltage power lines aren't going to be shielded and that modifications and equipment required to render their inherent antenna-like properties inert would have to be installed in such quantity and in such manner as to make BPL exorbitantly expensive.

Considering the fact that a recent proposal to allow for licensed-use allocation of frequencies between 135.7-137.8 kHz was denied by the FCC due to concerns over harmful interference to both the power line communications and the proposed new users highlights the existing level of concern about potential harmful interference in systems similar to BPL.

Since Access BPL equipment is installed on medium voltage lines that supply electricity to a residential neighborhood, should this equipment be treated as operating in a residential (Class B) or commercial (Class A) environment?

My understanding of the definition of Class A and Class B devices is as follows.

"Class A

A device which is marketed for use in an industrial application and is not intended for use in the home or residential area. Since the product is being sold to a commercial market, the emissions limits are significantly less stringent than Class B (residential) devices. Products that fall under the category of Class A do not require an official submittal, but simply need a Verification test performed and the data must be kept on hand by the manufacturer.

Class B

A device that is marketed for use in the home or a residential area by the customer. Class B devices can require either Verification, Certification, or Self Declaration depending on the type of product. Class B Verification is for devices that are marketed for in home use, but are not permanently connected to a personal computer. Computing devices and peripherals need to meet the same test limits, but the formal data needs to be submitted to the FCC for Certification, or the manufacturer can choose to issue a Declaration of Conformity under the new FCC DoC/Self Declaration Procedures."[1]

Although not marketed to or purchased by the end user, Access BPL equipment is required for delivery of end-use BPL service. Internet routers, which could be considered to be access devices indirectly utilized by consumers much in the same way that Access BPL equipment would be utilized (for example, Cisco's Model 12416 Internet Router) are very often Class A devices. However, the Cisco uBR10012 Universal Broadband Router, which is a cable modem termination system, is a Class B device, despite the fact that it's marketed to cable service providers and not end-users of cable modem systems. If Access BPL equipment would be placed in residential areas then the equipment should be treated as a Class B device.

Are the existing Part 15 rules for low speed carrier current systems adequate to protect authorized users of the spectrum who may be affected by the new high speed BPL technology? What changes to these rules, if any, are necessary to protect authorized radio services?

Due to the distributed nature of potential harmful interference from high-speed BPL technology, the existing Part 15 rules, which assume point-source interference, are barely adequate.

How should the Part 15 rules be tailored both to ensure protection against harmful interference to radio services and to avoid adversely impacting the development and deployment of this nascent technology?

Why should Part 15 rules be tailored for this specific case (BPL) at all? The rules exist for a reason and it's not clear that the underlying reasons have fundamentally changed just because of BPL. BPL is not new; BPL is the application of existing communications methodology to a transmission system that was built for another reason. Outside of the fact that using inferior transmission methods make broadband data harder to distribute and not easier, there are no compelling "scientific breakthroughs" here that obligate the FCC to alter Part 15 requirements.

[1] Definitions obtained from Product Safety Engineering, Inc literature.

It's relatively easy to scrape together a wireless/wireline system that operates at a rudimentary level, but to make a system with wireless aspects work well, without interfering with other present and future users of the radio environment, is quite difficult. The devil is always in the details, and rules that reinforce a high standard engineering should not be relaxed simply to allow deployment of a particular system that has inherent and seemingly insurmountable harmful interference qualities. This is similar to changing the rules for a company that doesn't want to comply with requirements for filing an environmental impact statement, simply because they might be from an industry that doesn't typically have to file environmental impact statements. No matter how hard they might spin their story, doing things that affect the environment in our modern day and age require adherence to the rules that govern environmental impact. BPL should not be treated any differently simply because it's portrayed as coming from "power companies" rather than "telecommunications companies."

Is there need to specify different limits for Access and In-House systems? For example, would it be appropriate to allow higher emissions for In-House systems where the user would be the principal party affected by interference, and could take steps to mitigate the interference, than for Access systems where the interference would affect a wider area and therefore be more problematic to mitigate? Would higher emissions for In-House systems result in any interference effects in other houses or apartments sharing the same local low voltage distribution by the RF signal being distributed on the low voltage side of the transformer? What limits should be specified, given the above considerations?

The user of an In-House system would not necessarily be the principal party affected by the interference. The question seems to assume a level of household isolation that does not exist. Since transformers are being bypassed by high-pass filter systems, the household environment would be exposed to a significant amount of existing noise from all the other users of the power line. I'm not sure what steps a BPL consumer could or would take to mitigate interference that would seem to be unbounded on the low voltage side of the transformer. Additionally, any product that was designed and/or installed with transformer isolation as a baseline assumption will be put at risk. Transformer isolation is used not only to efficiently distribute power, but has also become part of the engineering design landscape for proper operation of many household and business devices.

Separate Statements

I wanted to take the opportunity (which is greatly appreciated) to comment on some of the things said in the separate statements made by the Commissioners and Chairman. The reason I'm highlighting and responding to these statements is because they provide a great amount of insight into to the tone of this NOI and the underlying assumptions that will guide future decisions. Although I might take exception to some of the things that are said, my comments are in no way meant to be derogatory or disrespectful of the Commission or Commission members.

Commissioner Kevin J. Martin said in a separate statement "I wish to emphasize that the inquiry we commence today should in no way slow down BPL deployment."

This statement was amazing to read from the point of view of an electrical engineer with 5 years industry experience in developing wireless communications systems. If it is believed that BPL can actually be deployed effectively, efficiently, and correctly without slowing down that deployment (that could conceivably already be under way), then everyone involved with such a decision absolutely must educate themselves on the basics of technical issues concerning wireless

communications before allowing such statements to be printed on their behalf. There is no way that the current sketch-on-a-napkin, it-works-over-a-mile-in-limited-field-trials, wave-hands-at-the-issues sort of stage that BPL seems to be at can be deployed without serious problems between BPL consumers and the existing users of the spectra affected. Many of these existing users of the spectrum are extremely careful about causing harmful interference but can and will cause interference to BPL due to the serious lack of noise immunity that BPL suffers from. Broadband systems, especially with wireless components, are extremely complex. The concerns raised by myself and others by this NOI will undoubtedly slow down BPL deployment, even under the best of circumstances.

Commissioner Michael J. Copps said in a separate statement, “So I will vote to approve in part and to concur in part, and I look forward to working with the industry, the Bureau and my colleagues to nurture this exciting potential into early reality. It really might be a history-maker.”

This system could very well indeed be a history-maker. Most likely, as currently envisioned, it will make history as an exercise in how important correctly choosing the method of transmission of high-speed data is to the overall success of high-speed communications system. Deliberately choosing an inferior transmission media would seem to be a bad engineering decision that not even the most perfectly run of businesses could easily overcome in a quest for profitability. Why put yourself at such a disadvantage in a highly competitive market such as broadband communications? There are many risks in business worth taking, but BPL would not seem to be one of them.

Chairman Michael K. Powell wrote in a separate statement, "Power line networks are being tested today in a dozen states around the country and are a testament to the incredible innovations taking place in broadband network technologies."

I could find only eight states with field trials at the time of submitting this commentary. While I will continue efforts to find and evaluate the results of the other four states field trials that are “being tested today”, the part of this sentence that concerns me is the use of the phrase “incredible innovations”. BPL is not an “incredible innovation.” Innovation would imply something novel or new, something on the order of a fundamental paradigm shift in the way data is transmitted. Transmission of data through power lines has been done for quite some time. The transmission of high-speed data over power lines is something that many people, including myself, recognize as quite possible to do. However, just because something can be done, doesn’t mean that it should be done. There is a dizzying array of bad engineering ideas out there that can indeed be done, but should not be done, and are not done. I’ll go out on a limb and classify BPL as one of those bad engineering ideas. It’s up there with building bridges without looking at the aerodynamic properties of the elevated roadbed. Sure, the bridge was beautiful, but the Tacoma Narrows Bridge collapsed because it resonated at commonly occurring wind speeds.

From an engineering perspective, I’m not necessarily conservative. Having participated first-hand in bringing several products to market in my career that had been thought of as impossibly difficult to design only a few years previous to their full-blown commercial release, I’d like to think that I have a professional temperament that is balanced between avoiding risks and taking risks. My overall opinion of BPL is that it’s really not a good bet for a broadband system without a complete overhaul of the entire power line system or extensive use of alternate transmission media (such as fiber optic). An “incredible innovation”, to me, implies that neither a complete overhaul/upgrade of the intended transmission media or lowering/changing of the standards as expressed in a rules-set such as Part 15 should be necessary. An “incredible innovation” would, in

my mind, be something that allows a high-speed data system to easily pass all requirements of all users of all affected spectra while at the same time offering many times the bandwidth of competing systems at a tiny fraction of the price. BPL would appear to be inferior in most every way to existing broadband offerings, while potentially causing a tremendous amount of harmful high-frequency interference.

Thank you,
Michelle Thompson