

**Columbia Institute for Tele-Information
Alternative Broadband Platforms
Broadband Over Power Lines (BPL)
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**Statement of David Sumner
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Good morning. My name is David Sumner. I am Chief Executive Officer of the ARRL, the National Association for Amateur Radio. We are a 90-year-old, non-profit national association with 152,000 members. We also serve as the international secretariat of the International Amateur Radio Union, a federation of national organizations in 159 countries. Our headquarters is located in Newington, Connecticut, a suburb of Hartford. In all, we represent the interests of about three million ham radio operators worldwide including 680,000 in the United States.

As a group, radio amateurs are enthusiastic early adopters of new electronic technologies. The ARRL was one of the first membership associations to use the Web for information dissemination. Today, more than 90% of our members are on the Internet. We fully support broadband access being more widely available, at lower prices. You might wonder why a ham radio organization would be invited to participate in this panel. The reason is that we have unwillingly become experts on the issue of radio interference from Broadband over Power Line (BPL) systems.

There are three things I want to tell you this morning.

First, **BPL has an inherent technical flaw** – a potential to interfere with radio receivers – that is not shared by the other broadband platforms you will hear about today.

Second, while the flaw cannot be completely eliminated, its effects can be mitigated somewhat – but at **considerable expense** to the BPL system operator and with no certainty that the fix will be good enough to allow the system to operate legally. BPL proponents typically downplay the difficulty and the expense of solving interference problems.

And finally, **no BPL system operator can guarantee** that his system will always work, or even that it will be allowed to operate.

The problem is this, and it's very simple: **Power lines were not designed to carry broadband signals.** In the March 14 issue of *Computerworld*, Walter Adams of ComTek is quoted as acknowledging that “Electric lines are not designed to carry data.” Power lines are designed to be efficient conductors of alternating current at 60 Hz – what used to be called 60 cycles per second. What the FCC calls “Access BPL” uses frequencies between 1705 kHz and 80 MHz – that is, between 28,000 and 1.3 million times the frequency the power lines were designed for. So the power lines don't carry broadband signals very efficiently.

When you put alternating current on a conductor, the energy has to go somewhere. Some of the energy is dissipated as heat; that's not desired but is mostly harmless. Some of it is carried through the conductor to whatever it is connected to. That's what *is* desired in a BPL system. The rest of the energy is radiated. If the conductor is designed for the purpose of carrying broadband signals, such as the shielded coaxial cable used in cable systems, very little is radiated. But if you try to use a conductor designed for carrying one kind of energy for the purpose of carrying another

kind of energy, at a million times the design frequency, it shouldn't come as a surprise when it doesn't do the second job very well and a lot of the second kind of energy ends up being radiated.

You may recognize the terms kilohertz and megahertz from your radio dial, and that's exactly what these broadband signals are: radio signals. The frequency range used by Access BPL covers the entire short wave radio spectrum. These frequencies have the unique property that they are propagated by the ionosphere and can provide worldwide communication without any infrastructure whatsoever. When connected to an efficient antenna, a few watts of radio frequency energy – usually called RF for short – can be heard on the other side of the world. **This unique phenomenon is a natural resource that deserves, and receives, special protection.**

The technical problem for BPL system designers is that to a radio signal, a power line looks a lot like an antenna. Now, I'm not suggesting that a BPL system can be heard on the other side of the world. A BPL modem in fact contains a radio transmitter, but the energy is spread over a broad range of frequencies – that's why it's called broadband – so the energy on any single frequency channel probably isn't enough to be heard via the ionosphere. I say "probably" because the National Telecommunications and Information Administration – the NTIA, in the Department of Commerce – is still studying the aggregate effect of having hundreds of thousands of BPL devices deployed nationally. But if the signal from a BPL modem is strong enough to carry a couple of thousand feet down a power line, it's also strong enough to interfere with nearby radio receivers.

Let me show you what I'm talking about. Here is a 30-second video of actual BPL interference. As the video begins you will hear voice signals in the 14-MHz band that is allocated

internationally to the Amateur Radio Service. Then you will hear BPL interference obliterate the voice signals. This video was shot in mid-December 2004 in Briarcliff Manor, New York, just north of here in Westchester County. Note that the interference continues as the car moves, because it's being radiated by the power line that runs alongside the road.

[show video: Just Drive Through It – North State Rd Short Version.wmv]

I think you can see – or hear – why we radio amateurs are concerned. But anyone who is thinking about investing in BPL should also be concerned, because the interference you just heard is illegal. It is prohibited by the international radio regulations of the International Telecommunication Union, which the United States must observe as a treaty obligation. It is prohibited by the Communications Act. It is prohibited by the FCC's own rules.

Quoting from the international radio regulations, “Administrations shall take **all practicable and necessary steps to ensure** that the operation of electrical apparatus or installations of any kind, including power and telecommunication distribution networks,... does not cause harmful interference to a radiocommunication service....” Quoting from another section, “Member States recognize that among frequencies which have long-distance propagation characteristics, those in the bands between 5 MHz and 30 MHz are particularly useful for long-distance communications; they agree to make **every possible effort** to reserve these bands for such communications.” This is the special protection I mentioned earlier. Remember, these regulations have the force and effect of a treaty. The Communications Act and the FCC rules simply implement these international obligations.

Under the FCC rules, BPL is an unlicensed, unintentional radiator. BPL can only operate subject to the condition that **no harmful interference is caused to an authorized radio station**. That includes amateur mobile stations such as the one shown in the video. It also includes amateur stations in residences – most of them, of course, connected to power lines.

The FCC recently adopted rules imposing new requirements and restrictions on BPL operation. In particular, Access BPL devices using overhead medium voltage power lines are **prohibited** from using 12 specific frequency bands in order to protect communications with aircraft. This prohibition, and the other requirements of the new rules, applies to any equipment installed beginning in July 2006. To my knowledge, no BPL equipment now available complies with the new rules.

I wish I could tell you that the FCC adopted similar measures specifically to protect amateur stations. Unfortunately, although the FCC acknowledges that amateur stations use high-sensitivity receivers to receive signals from thousands of miles away, they are leaving interference to amateur stations to be resolved on a case-by-case basis. That might sound like good news for BPL operators, but it isn't.

Here is an important point. You may hear BPL proponents say that their equipment and systems meet the FCC emissions limits. That is a necessary, but not a sufficient condition for legal operation. If a BPL system exceeds those limits, it is in violation even if no harmful interference results. The problem is that those limits were originally set with intermittent, narrowband, point-source radiators in mind. Applying them to a high duty cycle, broadband emitter that is attached to a long conductor such as a power line is like saying that there's no difference between the noise of

a helicopter that goes over your house once a day and one that hovers over your back yard all the time. You wouldn't complain about the first, but you'd raise quite a fuss about the second.

As a case in point, last spring a small BPL system was tested in Cedar Rapids, Iowa. A radio amateur with a typical station was located about 600 feet from the nearest point of the test area. He experienced interference as soon as the system was turned on. The BPL operator and the utility spent the next **twelve weeks trying to fix it**. Despite devoting many hours of expensive engineering time to the problem, **they couldn't**. Ultimately the test was shut down prematurely, at least in part because it was the only way to eliminate the interference.

A letter from the NTIA to the FCC dated September 13, 2004 includes charts showing that at the FCC emission limits, the probability of interference is essentially 100% out to a distance of from 200 to 400 meters from the BPL system, depending on the operating frequency. In May 2004 an NTIA report concluded that interference is "likely" to fixed stations 460 meters from power lines. Interference has been observed at much greater distances – as much as a mile.

There is another dimension of the interference problem: interference *to* BPL from nearby radio transmitters. A broadband service provider that relies on BPL to deliver its service to a customer cannot guarantee the service will be available. As we have already seen, if the BPL system causes interference it may have to be shut down. But the BPL system also must tolerate any interference from authorized radio transmitters. We have documented cases where BPL data transfer was blocked by a 4-watt transmitter with a small mobile antenna. Amateur stations are authorized to operate at power outputs of up to 1500 watts.

Finally, it is not just radio amateurs who remain concerned, and who stand to be affected by BPL deployment. Some BPL systems use what is called low-band VHF, between 30 and 50 MHz, a frequency range that is used by first responders such as police, fire, and ambulance services. The FCC says it has 18,237 Public Safety licensees in this frequency range. The new rules require that complaints from public safety users be responded to within 24 hours. That's not much comfort to a person whose house is on fire and the fire truck can't hear the dispatcher, but it's something.

Anyone who listens to short wave broadcast stations may encounter interference from BPL. CB operators, maritime services, and a host of military and government stations use radio frequencies in this range. They all have rights as authorized radio stations. On the other hand, BPL systems have no right to use the radio spectrum. They are, as I said before, unintentional radiators. BPL is not a radio spectrum user. It is a radio spectrum polluter. And if the pollution causes harmful interference to an authorized radio station, the BPL system operator has the absolute burden of fixing it – even if that means shutting off the system.

So as you compare and consider the alternative broadband platforms discussed here today, keep this unique shortcoming of BPL in mind. Thank you for your time and attention. I look forward to your questions.

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