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

In the Matter of	)	
Inquiry Regarding Carrier Current	)	
Systems, including Broadband over	)	ET Docket No. 03-104
Power Line Systems	)	

REPLY COMMENTS OF
GARY W. BOX
To Comments of
UNITED POWER LINE COUNCIL
Dated 7 July 2003

These are Reply Comments of Gary W. Box to comments filed by the United Power Line Council, in this document referred to as "UPLC".

The writer received a BSEE and MSEE from UCLA, 1977 and has been employed as a electrical engineer involved in the power electronics and industrial electronics industries for 29 years, mainly in product development. This experience includes numerous encounters with FCC emission requirements including designing, building and testing equipment for compliance. The writer has also been issued 9 patents and currently holds the call sign N0JCG as a member of the Amateur Radio Service.

These replies take the form of excerpts from UPLC's original comment, noted as "Comment," followed by reply remarks, noted as "Reply". A number annotates each Comment and Reply. Replies commence immediately below.

1. COMMENT:
"Although many of the technological hurdles have been overcome, the principle obstacle that remains is in the range of BPL. Typically the BPL signal travels substantially less than a mile from the point where it is injected. Technically, BPL can be deployed in rural as well as suburban communities, but economically present FCC rules constrain such deployment."

REPLY
Access BPL is not the only way the utilities can achieve their goals. In fact it is not the most economical, easiest deployed, or reliable of the choices available to the utility. I would like to remind the Commission of their recent work on establishing the Unlicensed National Information Infrastructure band at 5Ghz. The very function of Access BPL is to be part of this infrastructure. It seems only logical that the utilities also use the U-NII band for this purpose. UPLC acknowledges that BPL is limited to substantially less than a mile and would like to increase power levels to go further. However by mounting U-NII nodes on power poles at appropriate intervals (between 1 and 10 miles) and at legal power levels, all the goals of the Commission, the utilities and even the manufacturers can be achieved without causing interference to any HF users. Perhaps more importantly, U-NII implementations such as the Motorola Canopy system can be deployed immediately, without any further Commission action.

The advantages of using the U-NII band over BPL are numerous:

1. No interference to any users in HF.
2. No need for frequency notches.
3. No direct connection to power line, other than for power.

4. Independent of powerline noise.
5. Independent of powerline impedance characteristics.
6. Independent of power grid switching
7. Independent of powerline reliability, with battery backup.
8. Independent of powerline routing. Only pole location is important.
9. Freedom to configure the network as desired; either with directional antennas or omnis.
10. No safety concerns.
11. No interference liability for the utility.
12. Cheaper hardware (5Ghz transverter should be cheaper than powerline inductive components).
13. Lower radiated RF power
14. Lower power consumption overall. Could be solar powered
15. System robustness
16. FCC gets its "third wire".
17. Providing rural service is trivial.
18. Strap-on installation means neighborhoods could be "wired" in hours, not months.
19. Cheaper installation
20. Little or no rule changes needed.
21. Bandwidth is almost four times wider than BPL, leading to higher performance.

2. COMMENT:
"The UPLC is pleased to respond that there has been no interference reported in any or the field trials by its members. These trials have been conducted in accordance with the existing Part 15 limits and measurement procedures. In many cases, the FCC has assisted in the test measurements that have been taken. The experience gained from this process indicates that BPL systems comply with the Part 15 limits, and that the existing rules protect licensed users against interference from BPL systems."

REPLY:
UPL is apparently not aware of the tests done in Japan, Germany, Austria, England and, most recently, the US, all of which show substantial harmful interference from BPL transmissions. UPL has also chosen to take the attitude of "pollute first and see who notices". It is quite easy to conduct tests on how BPL will affect amateur radio, short-wave and other HF radio reception, but they chose instead to proceed with transmissions at the Part 15 limit and wait for interference reports. Clearly these tests were not done with actual HF receiving equipment and installations. It should be pointed out that the BPL tests to date in the United States have been over a controlled and very limited geographical area with no parties interested in HF communications invited to participate. The commission should rely on testing with actual receiving equipment to determine interference, not interference incident reports.

Furthermore, the UPLC is under the mistaken notion that the Part 15 emission limits are a sort of digital threshold, below which there is no interference and above which there is. Harmful interference is defined as any repeated interruption of a licensed service, regardless of the RF field level from the offending device. Recent tests by the American Radio Relay League (ARRL) using a conventional mobile amateur radio configuration documented substantial harmful interference from several BPL systems. Several vendors have described their BPL systems as a wide band system using OFDM modulation to avoid frequencies in the amateur bands. Let's assume that a spectrum analysis of the BPL signal shows no BPL carriers in the amateur bands. How then did the sensitive narrow bandwidth amateur receiver pick up the out of band BPL signal? If we examine the characteristics of the received noise, we see that most of the interference is a series of random 'pops', which one party described as sounding like a 'Geiger counter'. They were very short, but very often, impulse noise transients. OFDM modulation creates as many as 256 (or more) discrete RF carriers and imposes a separate bit stream on each. The 256 carriers suddenly appear, transmit their bit streams, which form the packet, and then are extinguished. If the leading and trailing edges of these carriers are fast, the edge of each packet will look like an impulse excitation to the power line. The spectrum of an impulse is spread infinitely across the spectrum. The power line obediently reacts to this excitation as the distributed, unbalanced, resonate wire structure it is and an impulse of energy is radiated all across the HF spectrum. The phenomena would occur at every edge of every packet.

In the Amateur Radio Service this effect has been known for 80 years as “key click”. A CW (Morse code) transmitter operates by turning the carrier on and off as the key is opened and closed. In much the same way that the BPL OFDM signal turns its 256 carriers on and off at the beginning and end of the packet, although at a considerably slower rate. In CW, ‘key click’ is fixed by controlling the rise and fall times of the RF envelope, effectively passing the RF envelope through a low pass filter.

Unfortunately for BPL, passing the signal through a low pass filter will slow the baud rate substantially. OFDM works great in a band where all users are using the same modulation scheme because OFDM itself has good immunity to this effect. This is why there should be no conflict between access and in-home BPL. However, on the HF band, where the development emphasis over the last 100 years has been on raising signal to noise performance by designing ever-sharper filters and highly bandwidth conserving modulation schemes, a mode that continually generates impulse noise is incompatible.

Existing Part 15 devices in the 2 to 80MHz spectrum are all either narrow band or infrequent emitters and can been tolerated. The HF band is no place for wide bandwidth spread spectrum.

3. COMMENT:
Access BPL systems should be treated as Class A equipment for purposes of radiated emission limits.

REPLY:
With this, and other comments, UPLC makes it clear that they are seeking to have the Commission impose the highest possible RF emission limits on BPL technology. They are thus admitting that the power line is a poor conductor of RF and they need to increase the radiated energy level as high as possible to get sufficient performance. The conducted limits were set after significant study by the FCC. The power distribution system will react the same to RF energy whether it is from noise or intentional BPL injection. By raising the conducted limits the commission would be throwing out almost 20 years of progress in suppressing unintentional HF RF emissions.

Respectfully Submitted;

Gary W. Box