

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554
27 July 2003**

In the Matter of)
Inquiry Regarding Carrier Current)
Systems, including Broadband over)
Power Line Systems)

ET Docket No. 03-104

REPLY COMMENTS OF CORTLAND E. RICHMOND, Jr.
to
Comments of PowerWAN, Inc., dated July 3, 2003

These are Reply Comments of Cortland E. Richmond, Jr., to Comments of PowerWAN, Inc, in this document referred to as POWERWAN, in the matter above, dated 3 July 2003.

The writer has been involved in EMC and EMI engineering since 1983, spent 21 years in the United States Army working with airborne and ground communications equipment, and has been an Amateur Radio operator since 1958.

These replies take the form of excerpts from POWERWAN's original comment, noted as □gComment, □h followed by reply remarks, noted as □gReply. □h A Roman numeral annotates each Comment and Reply. Replies commence below.

I

Comment:

POWERWAN, INC believes that Access BPL would use the spectrum from 2-50 Mhz. The reason for this choice is that frequency reuse of portions of this spectrum with significant data throughput would be facilitated. This would allow some ability for noise avoidance by not using some frequencies, as well as not using portions of the spectrum where other services are located, such as the amateur radio bands.

Reply:

POWERWAN here mistakenly assumes that the spectrum referenced is mostly unused. However, the table of allocations shows Federal allocations at 2 – 30 MHz for Fixed and Mobile, Mobile, Standard Frequency and Time Signals, Broadcasting, Aeronautical Mobile, Maritime Mobile, and Radio Astronomy. Also: non-government allocations for Broadcasting, Maritime Mobile, Fixed, Mobile, Land Mobile, Aviation, Private Land Mobile, International Fixed, Industrial Scientific and Medical equipment, Remote Pickup, and Auxiliary Broadcasting. FCC 15.205 protects eighteen frequencies from Part 15 intentional radiators.

II

Comment:

POWERWAN, INC. believes that Access BPL and In-house BPL can coexist. If the assumption is made that the 30-50 MHz band can be used by BPL, as well as the 2-30 MHz band, then the argument could be made that certain portions of the available bandwidth could be given preference for Access or In-home use.

Reply:

The assumption POWERWAN makes is unwarranted. A search of the Commission's Universal Licensing System shows 3748 licenses for 30 – 50 MHz in California, POWERWAN's home state, alone, with many of these being local and state government law enforcement and public safety agencies. If one conservatively estimates that licensees will incur costs of \$1 million each to replace current radio systems, and that BPL providers will be required to compensate them for the cost of moving, the resulting \$3.5 billion dollar price tag for California alone may be expected to make hash out of that assumption.

III

Comment:

Data Transmission speeds that Access BPL can achieve are governed by the bandwidth that is allocated to a particular data channel. If the whole band from 2-50 MHz is used, then the speeds should be in the range of 100 Mb/s. On a shared basis, the speeds are governed by the over subscription rate that is used, and the amount of frequency reuse that can be implemented. Greater than 1 Mb/s per user is typically supported. The data rate per user will be largely symmetrical, though this is governed by the relative noise levels at the customer premise and on the power line.

Reply:

This is a realistic appraisal of the bandwidth that would be possible with BPL if it occupied the spectrum it assumes. It is not an optimistic one for BPL's success in the marketplace, requiring, as it would, exemption from existing limits on radio interference, compensation of licensees deprived of the use of their radio systems, and deployment of a whole new generation of equipment merely to equal services already being provided over telephone copper, coaxial cables, licensed and unlicensed microwave, fiber, and satellite links.

IV

Comment:

Standards work has not been done domestically or internationally other than ETSI. POWERWAN, INC believes that it is still too early for standards work to be successfully embarked upon, as there are no deployments large enough to provide the real world experience to prove or disprove technologies and techniques.

Reply:

Lack of standards implies equipment with which no one else can communicate. However, this argues against any interest POWERWAN may have in BPL but its own; a nationwide technology is more easily deployed nationally if standards exists for its hardware and software, and its reliability – crucial for some of the needs POWERWAN asserts BPL would meet – may only be assured by adequate and widely accepted standards.

V

Comment:

There are other in-house BPL systems in Europe that operate in a portion of the same spectrum.

Reply:

Initial deployments in Europe were curtailed due to radio interference, expense, and other business related reasons.

VI

Comment:

POWERWAN, INC. uses both capacitive and magnetic couplers for injection and reception of power line signals on medium voltage and low voltage lines. Implications are that lower radiation emissions are seen on lines where they are closely balanced, using a differential method of signal injection.

Reply:

This writer agrees that properly balanced lines would indeed reduce emissions. However, even perfectly balanced lines, if not in close enough proximity to each other (less than about 0.01 wavelength) , and properly terminated, do radiate. Medium voltage lines spaced one meter apart are unsuitable for transmission of radio frequencies beginning in the low MHz range, and long transmission lines so made are occasionally used as traveling wave, directive antennas. Moreover, the balance required to obviate harmful interference at the HF and lower VHF frequencies POWERWAN expects will be used is not achievable in practice. POWERWAN in any case has no control over line balance or radiation, that being determined by other entities, and its statements deprecating the potential of BPL systems to cause harmful radio interference should not be relied upon.

VII

Comment:

Definition of frequency bands that must be avoided or have significant signal attenuation would help, especially in particular areas such as the amateur radio bands. Notching out of particular frequency areas in an OFDM signal is routinely done. This would allow continued use of radios in these frequency bands without interference.

Reply:

POWERWAN here admits that BPL is incompatible with an existing HF radio service. As the writer has already noted there are many more users of the HF and low-VHF spectrum than Amateur Radio, and notches needed in BPL spectrum would be far more numerous than the few Amateur bands it proposes to protect. This would markedly decrease the bandwidth available to providers, and further reduce BPL's attractiveness to subscribers who have now, in the event, other choices. Moreover, there is a limit to how deep a notch may be provided near frequencies that remain in use, and this too would reduce the usefulness of BPL.

VIII

Comment:

POWERWAN, INC. believes that the medium voltage power line should be considered as a class A environment, as there is no chance that the medium voltage will ever enter a home, except under extreme fault conditions.

Reply:

This writer disagrees with POWERWAN's belief. Barring use of wireless links to Access BPL, BPL would necessarily introduce conducted currents into the residential environment its putative subscribers inhabit. The Commission has specified a level of conducted current, at 15.107(a), above which unacceptable interference for a residential environment would be created. This writer believes that level inadequate for a widely deployed BPL, but apart from that, BPL, if it introduced radio frequency currents onto residential wiring, should indeed be required to conform to Class B conducted current limits.

With respect to radiated emissions, it is the writer's belief that an unintentional radiator which generates a field in a residence greater than a Class B device does, should not be regarded as a Class A device.

IX

Comment:

Access field tests to date have not resulted in any complaints, either from the customer or from the customers. neighbors. As said previously, continuous use of In-house BPL does not appear to be noticeable by other family members.

Reply:

It is not stated here that either the customer or the customer's neighbors were in users of the HF radio spectrum. An interference test that does not include its victim says nothing about BPL compatibility with that user.

X

Comment:

POWERWAN, INC. believes that the existing part 15 rules for low speed carrier current systems are adequate for BPL testing, but will pose economic impact on full deployments.

Reply:

POWERWAN's statement is true, but insufficient. Reasonable regulation is part of the cost of doing business.

XI

Comment:

POWERWAN, INC. believes that BPL Access should be treated as a service that provides better usage of existing power company assets to provide data access and other value-added services to customers who would otherwise not be able to obtain these. As such, less regulation, including an upward adjustment of Emission rules for carrier current systems to 100 uV/M at 30 meters, will facilitate lowering the cost of Access BPL by lessening the need for repeaters to provide broadband in urban and especially, rural areas. Moving the Emission limit breakpoint from 30 MHz to 50 MHz will help facilitate higher bandwidth and better frequency reuse schema. It also will allow better planning between Access and In-House BPL. As many of the radio services that were authorized to operate in the 30 to 50 MHz band have moved to higher frequencies, this band has received lower usage, and could be re-used for the good of the public by higher limits for Access BPL.

Reply:

Here, POWERWAN asks the Commission to relax protective requirements already known to be loose ones, in order to realize a monetary advantage. The Commission should decline to grant this request. It would result in yet higher levels of harmful interference to authorized radio services, where BPL and (overseas) high-frequency PLC have already been shown to create interference noise floors many dB above the residential ambient at frequencies POWERWAN wishes to use, and would render further allocation of the radio spectrum impossible by fiat.

XII

Comment:

To date, Access and In-House BPL has not been shown to be detrimental to radio services. As is seen in many other bands, radio services are migrating to digital technology with forward error correction, with strong benefits to users including higher capacity. As cellphone users know, digital technology produces clearer and higher quality calls. The side benefit is that the available spectrum is better utilized on an information density basis due to higher order modulations that can be used. As the bands from 2-50 MHz are used more by digital technologies such as BPL, better utilization of these important frequencies will result. The radio services in this band will also benefit users by going from analog to digital technologies with modern modulation methodologies.

Reply:

POWERWAN'S argument is akin to declaring that since people travel fastest by airplane, the highways should be taken over by trucks and those who used to drive, should be forced into airliners. It is an argument attractive only to those who might make money pursuing it. Loss of the radio services BPL would render unusable would inflict harm that far outweighed the benefit of the incremental increase in broadband access BPL might provide, and the financial impact of replacing them would be horrendous.

XIII

Comment:

Both In-House and Access BPL should use the same radiated emission specifications. POWERWAN, INC. believes a level of 100 uV per meter at 30 meters, would be reasonable for both In-House and Access BPL below 30 MHz, due to the nature of the signal being wideband, rather than single carrier.

POWERWAN, INC. believes that radiated emission limits are adequate to control interference for both high and low speed BPL systems.

Reply:

The writer and others (see ARRL comment) have already noted that radiated signals at levels currently permitted – but at present rarely encountered except at discrete and occasional frequencies– can indeed cause harmful interference to HF spectrum users. ARRL studies detail how even a wideband signal can cause excessive and harmful interference, and the experience of HF radio users in Germany and other overseas locations where BPL (there called PLC) has been deployed bears this out. This being the case, the increased level POWERWAN asks merely adds injury to injury; when one's knees are being broken, he worries little about his toes.

Radiated emission controls are necessary, though not, at present, adequate for a ubiquitous emitter such as BPL. The Commission should not only deny POWERWAN'S request to raise the level permitted, but reduce it to levels which would allow coexistence of HF and low-VHF radio with such systems.

XIV

Comment:

POWERWAN, INC. believes that a standardized measurement method would be good for the BPL industry. Utilization of a standard antenna for Access BPL, that is easily calibrated and mobile, would be of great assistance. A part of this issue is that each power line installation is somewhat different, and a representative installation would have to be defined or built. Open site testing would be preferred over laboratory testing. The same antenna could also be used for In-House BPL, if physical size permits. The measurement procedures for low-speed carrier current systems should not be used, due the fact that they are characterized for single carrier systems, which occupy very little spectrum.

POWERWAN, INC. has typically used differential injection, though arguments can be made for common mode injection. Again, only radiated emission measurements should be used.

POWERWAN, INC. Belives (sic) that overhead power line testing for radiated emissions is the proper way to test Access BPL, and that attempting to test on a power line for conducted emissions is a difficult and unnecessary task. As measurements will be taken in the near field at the frequencies of interest, the measurement should be in the form of dBuv/MHz.

Reply:

POWERWAN identifies a problem which has bedeviled other technologies. It is difficult to build one single antenna which is adequately sensitive, resistant to overloading, portable and wideband enough for the range of frequencies POWERWAN has in mind. However, POWERWAN'S preferred radiated test method is unwieldy enough to make lack of a suitable single antenna unremarkable.

The writer in Comments has suggested a standard radiating structure, perhaps a loop of known area, which could be used on a 10 meter Open Air Test Site (OATS) with suitably adjusted limits and appropriate detectors. The writer believes it appropriate to require peak detection, since that is an interference to which victim receivers are susceptible .

The writer has already noted that conducted emissions should also be measured, in order to protect residential environments from RF currents beyond the Class B limit. If either is to be omitted, conducted testing should be preserved, as it is attached conductors which are most likely to radiate harmful interference in the HF range. However, suitably lower limits should be adopted to insure harmful interference does not arise.

XV

Comment:

POWERWAN, INC. believes that BPL equipment should go through the Verification process, and not the Certification process. As pointed out, existing carrier current equipment has not been a source of harmful interference using the Verification process.

Reply:

If deployed, BPL should be kept under strict oversight, at least until it has established a regulatory history. Nothing like it has ever been marketed, and even POWERWAN'S own statements and requests – higher limits, notches, moving radio users to digital, with error correcting modes (presumably because BPL would interfere too much otherwise) and migration to higher frequencies – do not justify relaxed supervision.

XVI

Comment:

POWERWAN, INC. does not believe that the multicarrier signal imposes a higher risk of interference with existing licensed radio services, as notching, and other techniques can be used to mitigate this issue.

Reply:

The multicarrier emitter offers a rather higher chance of interference, as it contains carriers about which modulation sidebands manifest themselves to victim receivers.

XVII

Comment:

The Access BPL modems should be subject to equipment authorization. As all equipments located outside the house will be installed by trained personnel, these would be covered under the verification program. The only item a consumer would install would be an In-house modem, by plugging it in to an existing power outlet.

Reply:

Unless and until BPL has established a regulatory history, all its component equipments should be subject to Certification. Those who introduced RF into a structure would of course be required to correct any resulting radio interference.

XVIII

Comment:

The question of replacement of existing power line carrier (PLC) systems is not clear at this time. It is POWERWAN, INC.'s experience that power companies would like to see the additional data handling capability of BPL, but they realize that certain issues must be considered. One of the main issues is that PLC systems today do use higher power to provide their signals over long distances. These higher power signals are necessary for long distance signal transmission and would likely cause more radiated emissions in a different frequency band than is presently being utilized. Also, the frequencies presently used by PLC have lower losses per distance than those utilized today by BPL. The different systems, being in different frequency bands, would coexist with few problems. As techniques exist to filter the signal at desired locations, a coordination process would not be necessary. As to whether the PLC systems using BPL technology are subject to the Access BPL requirements would depend on the frequency band being used. If the Access BPL system in the 2-50 MHz band is carrying both broadband and monitoring signals, it would be subject to the rules of Access BPL. POWERWAN, INC.'s equipment separates these signals at higher layers, and provides security for both.

Reply:

In these remarks POWERWAN acknowledges that BPL would require more power than PLC does, and would radiate more than PLC. The writer agrees with POWERWAN that utility use of BPL would have to comply with the same rules, which necessarily includes acceptance of radio interference, as any other Part 15 HF device. In this connection, it should be noted that the Commission has, in exception to Part 15, protected LF PLC administratively, without comment or public input. This protection could not be expected to extend to a BPL system of whose users a utility happened to be one.

XIX

Comment:

POWERWAN, INC. believes that BPL does not pose significant risks for unintended high frequency radiations that will interfere with consumer devices, amateur radio operators, or other forms of commercial communications (television, radio, mobile radio, etc.). This belief is held for several reasons, described as follows:

Reply:

POWERWAN has already tacitly admitted that without corrective action, interference would indeed occur, else why call for notches in the spectrum BPL might use, or ask radio users to migrate to higher frequencies, or to use digital, error correcting codes, when none have yet been needed? POWERWAN'S assertions are dealt with below.

XX

Comment:

Equipment Vendors will FCC-Verify their access and in-home BPL technologies.
POWERWAN, INC. is working with consultants to verify the PowerWAN access and in-home equipment. In tests to date, the results are promising.

Reply:

The Commission already requires equipment using radio frequencies comply with provisions of Part 15. POWERWAN'S optimism, in light of its requests for increases in permitted emissions, seems misplaced.

XXI

Comment:

BPL In-home Consumer products are FCC Part 15 verified. HomePlug™ 1.0 compliant bridges, routers, and adapters from Asoka, LinkSys, NetGear, and Siemens have been FCC certified and UL approved.

Reply:

See XX, above. Also note that BPL is a novel concept, for which novel limits must be developed, as its impact on users of the HF and low-VHF spectrum promises at this time to be disastrous.

XXII

Comment:

Tests have not revealed any issues. In POWERWAN, INC.'s(sic) first three-month BPL deployment, no public complaints were registered for access or in-home related interference. POWERWAN, INC. has conducted its own in-home testing with a number of consumer devices, such as household appliances, televisions, and radios, and did not observe any radiated emissions interference from BPL signals on the in-home wiring.

Reply:

It appears from POWERWAN'S comments that it did not test with portable or tabletop short-wave receivers.

XXIII

Comment:

Providing broadband access to many people that would not otherwise be served.
POWERWAN, INC. believes that BPL provides the best means for providing broadband access to customers that would not be served, due to various reasons, by other technologies.

Reply:

If it really were the best, would POWERWAN have to ask for exemptions from and changes to regulations all the others can live with? A one-dimensional analysis such as POWERWAN's does not take into account anything other than its hopes. Utilities have been ruined selling hopes.

XXIV

Comment:

In summary, POWERWAN, INC. believes that FCC Part 15 radiated compliance rules sufficiently govern both access and in-home BPL technologies. POWERWAN, INC. also supports elimination of conducted limits, as radiated emissions are the true indications of interference potential.

Reply:

Good and sufficient evidence exists that Part 15, as it is now, does not sufficiently protect HF radio users from the novel threat of the magnitude of BPL. POWERWAN appears to have had some inkling of this, as it has asked for increases in radiated emission limits, and exemption from conducted ones. The loss of entire radio services merely to give a few companies a go at making more money, is too high a cost to let BPL go on as it is. The Commission should deny POWERWAN'S requests for relief from relief from and amelioration of Part 15 requirements.

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The writer desiring that the Commission examine POWERWAN's comments with the above in mind, these replies are respectfully submitted,

Cortland E. Richmond, Jr., KA5S

28 July 2003