Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of Inquiry Regarding Carrier Current Systems, including Broadband over Power Line Systems	)	**ET Docket No. 03-104**
By W. Lee McVey, P.E.,	)	
To: The Commission	)	

COMMENT

I. Background

1. The following comments are based largely upon my personal experience through my former employment with the Pacific Gas and Electric Company from 1971 through 1990, in a variety of engineering, maintenance and operations assignments.

2. These comments are offered to share my experience with the Commission in its consideration of the feasibility, cost-effectiveness, and practicality of the proposed wide band, high frequency, Access Broadband Power Line (ABPL) carrier deployment.

II. Early Underground System PLC Deployment A Failure

3. During the early 1970s, the Pacific Gas and Electric Company and the General Electric Company participated in a joint design and development project to employ power line carrier (PLC) technology to remotely control large end-user appliances and to read residential electric meters. The project involved injecting a PLC signal in the 100-200kHz range on what were primarily underground high voltage cables from distribution substations out to individual homes and back to the substations.

4. The project was abandoned, after considerable testing and equipment development because there was too much attenuation of the PLC signal between the end user and the substation. Although I do not recall if series inductor, tuned wave traps were used to decouple the carrier signal and bypass each distribution transformer, there was general agreement that the primary reason for the concept's failure was the industry-standard design of underground high voltage (HV) cable, that, by its very nature, attenuated the propagation of the PLC signal, making satisfactory two way communication impossible.

5. It is common knowledge that at frequencies of a few kiloHertz and higher, the skin effect forces alternating current to the outer most conductive surface of the center conductor in a cylindrical, coaxial cable. HV solid dielectric cable, which resembles large coaxial radio frequency transmission line, has a 15 to 30 mil layer of carbon-impregnated material around the center conductor to equalize the 60Hz electric field intensity radially about the center conductor. This layer, because of the skin effect, became the conductive layer for the PLC signal and greatly attenuated its propagation

along the distribution cables.

6. There is little doubt that in order to propagate ABPL along such lines, enormous power levels would be required at both end user and substation source ends to effect satisfactory two-way communication.

7. Since essentially all new installations employ underground HV distribution cables which run for miles from substations to pad mounted and subsurface transformers in neighborhoods, any proposal to use of two way ABPL would be quite questionable. In addition, the service drop conductors, which run from pad mounted and subsurface transformers are directly buried, thinly insulated, triplexed cables which would similarly attenuate these signals in the last 100 feet or so from the transformer to the residence. While these cables have performed adequately at traditional 100-200kHz PLC frequencies for In-House PLC appliance control from adjoining residences on the same transformer secondary, it is reasonable to expect that much higher signal levels will be required to traverse even 100 feet or so underground back to a transformer secondary on the ABPL frequencies ranging from 2 to 80MHz. These cables are typically unshielded, and are insulated with only 40-90mils of polyethylene or polyvinyl chloride insulation. The insulation is normally heavily saturated with moisture and would very likely severely attenuate ABPL signals.

8. All of this leaves open the question of what power levels would be necessary to effect propagation of the many miles necessary for ABPL to operate satisfactorily? If the proposal only involves the use of overhead lines, then it will not serve the interests of the

majority of the public at large, since, for the last 40 years or more, residential housing developments in the US have been all supplied by underground power systems. Thus, by permitting a technology which is designed to serve only those located in 40 year old or older residential areas in cities, and individual, isolated homes in rural areas, the interests of the majority of citizens will not be served through an overhead-only ABPL deployment.

III. Utility Telecommunications Staffing

9. Over the last 15 years, the electric utility industry has gone through a series of mergers and consolidations in the interest of reducing the cost of system operation. Primarily, this has been accomplished by reductions in personnel. Especially so for those with specialized technical responsibilities, thought to be duplicated by other, non-utility businesses.

10. One of these 'niche' functions is utility telecommunications. At Pacific Gas and Electric, telecommunications technicians handled not only PLC systems, but company telephone systems, company two way mobile and base radios, microwave systems, computer networks, and last, but not least, radio and television interference complaints.

11. While I cannot speak to present staffing or responsibilities of individuals, when I left Pacific Gas and Electric in 1990, many of the telecommunication personnel and their functions were being eliminated and replaced by contractors. Two way radio

maintenance and installation was one of the first functions to be eliminated and contracted out. Radio and Television Interference complaints, even before that time, were not considered a high priority. And, only very few telecommunications technicians at that time had the expertise and knowledge of radio frequency interference test equipment to track, identify sources, and reduce or eliminate interference.

12. In view of the foregoing, I would ask that the Commission carefully examine any experimental or demonstration projects and the ability of utilities to respond and to mitigate any interference complaints from Access BPL.

V. Utility Issues Involving PLC and Proposed ABPL

13. Existing low frequency PLC use by utilities is limited and rudimentary as demonstrated by systems and concepts that have changed very little from their inception in the 1930s. Utilities, such as Pacific Gas and Electric, that have extensive and complex systems have already all but abandoned PLC in favor of redundant, self-healing ring configurations of multiplexed microwave or fiber optic media. PLC outages have been numerous on Pacific Gas and Electric company's facilities over the years. And, since many of the problems dealt with series inductor and wave trap malfunctions, an outage of the particular power transmission line was required to replace or retune the wavetrap components. Since portions of bypass couplers designed to couple the ABPL signal around distribution transformers will be energized at 15-44kV, adjustment or replacement of these devices may very likely require multiple outages of the electric distribution system to repair, replace or otherwise adjust bypass devices to obtain

satisfactory ABPL performance.

14. Also of concern would be the effect of phase to phase and phase to ground connected power system components, such as distribution line regulators, booster transformers, and capacitors, on ABPL propagation and radiation. Since capacitors would most likely require some form of wave trap to prevent them from significantly attenuating and/or outright grounding ABPL signals, the effects of such devices need to be carefully evaluated for resonance and/or sources of interference. Electrically, these units are connected between phases, and not directly connected to ground or common neutrals. However, there is a significant case to ground capacitance which may effect ABPL characteristics. Some capacitors are designed to be switched on and off, depending upon system voltage and power factor requirements, either at fixed times or based upon voltage or power factor and may result in varied ABPL performance which would be difficult to control.

15. Electric utility power system distribution circuits are often times geographically rerouted either temporarily because of system damage or failure, maintenance work, construction/reconstruction or seasonally to adjust for changing system load conditions. Reconfiguration is accomplished by opening and closing numerous switches on distribution feeder lines. Often, these changes may involve switching circuits not only to different substation transformers, but to completely different substations as well. Reconfiguration would most likely effect the routing of ABPL desired signal paths and resulting signal levels by either increasing or decreasing physical distances involved to

end users. And, if multiple, uniquely addressed ABPL signals are involved, some means would be necessary to reconfigure affected users and ABPL signal levels almost immediately on a 24 hour, 7 day basis.

IV. An Alternative Proposal

16. As stated above, for the last 40 years, all new distribution systems in developed areas have been placed underground. And, by their very nature, underground distribution lines and other power system line devices such as capacitors and line regulators may greatly attenuate the propagation of Access BPL, making practical application to the vast majority of residential users impractical. And, planned and unplanned power system reconfiguration would pose significant challenges to an ABPL signal impressed on distribution feeders.

17. Demonstrations of HF PLC on overhead systems, if successful, will only meet a very small segment of need for additional telecommunication services to remote and rural areas. And, at the likely expense of significant direct interference or high noise levels for other HF or VHF licensed users. Of special concern would be the effect upon public safety and essential services that are inherently susceptible to elevated noise levels, such as aviation (HF SSB and VHF AM) and FEMA, military and maritime (HF SSB) communications. Unplanned and unforeseen increases in ABPL signal levels may interrupt or otherwise prevent critical communications at times of greatest need.

18. Technology exists to install fiber optic core cables within stranded overhead power cables. By simply replacing or reconductoring, as it is called, one of the existing overhead conductors with such a fiber optic center-core-cable, far more useful capacity can be obtained without the inherent pitfalls of Access BPL to other licensed spectrum users to achieve high speed internet service to both urban and rural communities. In fact, for the last 15 years, electric utilities have installed such fiber core center cables atop their cross country electric transmission lines to utilize for their own communication and control needs and to offer capacity to other users. In addition to high speed internet services, a fiber optic core cable system could additionally provide other enhanced services such as cable television and telephone services over the same fiber conductor path. By their very nature, fiber optic cores and fibers are very small and non-conductive and can easily be brought from the center of even energized 15-40kV conductors or a common neutral conductor to a termination point. Fiber optic cables are widely used today in utility high voltage metering, protection, and control applications in the electric utility industry for these very reasons.

19. Furthermore, switching and reconfiguration of distribution lines does not involve grounded common neutral conductors as they are interconnected. If a fiber optic core conductor were to be utilized as a distribution line common neutral or alongside underground lines in conduit, switching or reconfiguration of signal path would not be necessary in the event of power system reconfiguration. In those few instances where common neutrals do not exist, fiber optic conductors would need to be routed around any distribution line switches in any case, as part of the original installation process.

20. Unfortunately, as stated above, many underground cables are directly buried, but some are installed in conduits. Conduits, where they exist, could be used as an existing path to install a very small fiber optic cable alongside existing power cables. Also, directional boring equipment is now available, where no conduits exist, that can very economically install small conduits without destroying existing substructures, pavement or landscaping, right to the end-user residence, eliminating the need for Access BPL in underground service areas.

21. In view of the foregoing, I ask that the Commission deny the proposed adoption of Access BPL in favor of a more practical, reliable and universally deployable fiber optic alternative; and to consider carefully the In House BPL proposal as to its effects on other licensed services operating in the HF and VHF spectrum.

Sincerely,

/s/

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