To: Federal Communications Commission
Washington, DC

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20 August 2003

On the Matter of Notice of Inquiry 03-104 (Broadband Over Power-Line)

The undersigned has reviewed the following listed technical papers on BPL (Broadband Over Power Line) authored by Ed Hare , ARRL Laboratory Manager, and found these to be complete and correct in every detail to the current Engineering state-of–the art. These papers made use of relevant data where applicable and made reasonable conservative assumptions where no hard data was available. They (and other supporting empirical-based information) demonstrate conclusively that deployment of BPL as proposed in the Commission' Notice of Inquiry 03-104 will cause harmful interference in the 1.7-80 MHz frequency band.

1) Methods of Feeding Overhead Electrical Power-Line Distribution Lines
With BPL Signals and the Relationship of These Methods to the
Radiated Emissions of the Conductors

2) Calculated Levels from Broadband Over Power Line Systems and
their Impact on Amateur Radio Communications

3) Electric and Magnetic Fields Near Physically Large Radiators

4) Power Lines as Antennas From 100 kHz to 50 MHz

Author: Ed Hare, ARRL Laboratory Manager Date: July 7, 2003

Additionally, the undersigned has performed antenna modeling of a similar power line system with very nearly the same results as the ARRL papers. The model used in my case was a pair of 500 ft parallel transmission copper AWG#12 wires with 4 ft spacing 30 ft above average earth ground. The BPL feed method is differential, at the center point, 250 ft from either end. In some cases the antenna gain of my power line system is greater than the ARRL's model, but never is it significantly less. The model and its current distribution is diagrammed below in Figure 1. A representative 2-D antenna elevation pattern is shown for 14 MHz. at Figure 2. Also a 21 MHz model and its current distribution is diagrammed below in Figure 3. The 21 MHz 2-D antenna elevation pattern is given at Figure 4. The tabulated results for isotropic gains from 7 to 50 MHz are given in Table 1. The software used is ezNEC 3.0 demo, a proven antenna modeling program based on the NEC- 2 (National Electromagnetics Code) developed by Lawrence Livermore National Laboratories.

The simulation results show very significant antenna gain at low radiation angles which can result in strong field strength into residences at approximately same elevation. This would result in the high levels of harmful interference correctly predicted by the above technical papers and verified in field tests. Contrasting the antenna gains seen here with the radio frequency isolation afforded by coaxial cable (as deployed in cable modems) or carefully differential balanced lines with limited bandwidth (as deployed in DSL service) one can see an approximate 60-80dB reduction in harmful interference as compared to the proposed BPL service.

In conclusion, the deployment of Broadband over Power Line service can be expected to cause very severe harmful interference to many other services now using the 1.7-80 MHz spectrum.

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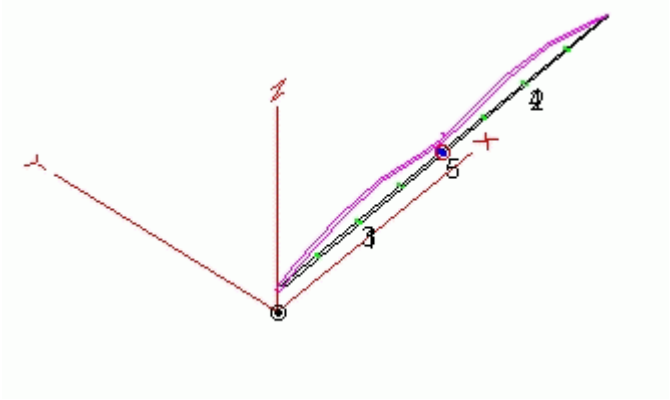
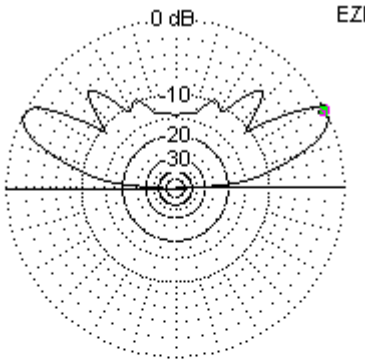


Figure 1 Antenna and Current Diagram 14MHz



EZNEC Demo

14 MHz

Elevation Plot		Cursor Elev	27.0 deg.
Azimuth Angle	57.0 deg.	Gain	11.91 dBi
Outer Ring	11.91 dBi		0.0 dBmax

3D Max Gain	11.91 dBi
Slice Max Gain	11.91 dBi @ Elev Angle = 27.0 deg.
Beamwidth	15.9 deg.; -3dB @ 17.3, 33.2 deg.
Sidelobe Gain	11.91 dBi @ Elev Angle = 153.0 deg.
Front/Sidelobe	0.0 dB

Figure 2 Radiation Pattern (Elevation) 14 MHz

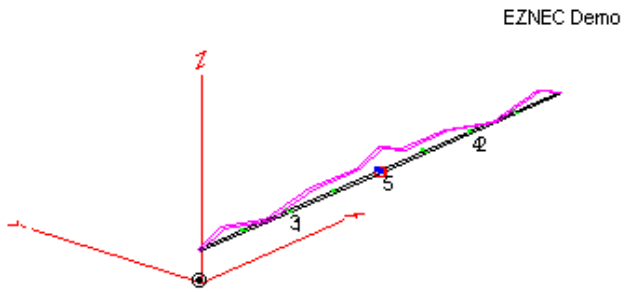
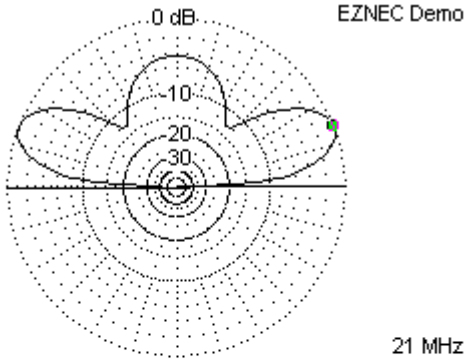


Figure 3 Antenna and Current Diagram 21MHz



Elevation Plot		Cursor Elev	21.0 deg.
Azimuth Angle	87.0 deg.	Gain	10.15 dBi
Outer Ring	10.15 dBi		0.0 dBmax

3D Max Gain	10.15 dBi
Slice Max Gain	10.15 dBi @ Elev Angle = 21.0 deg.
Beamwidth	23.5 deg.; -3dB @ 10.2, 33.7 deg.
Sidelobe Gain	10.15 dBi @ Elev Angle = 159.0 deg.
Front/Sidelobe	0.0 dB

Figure 4 Radiation Pattern (Elevation) 21 MHz

Table 1. Summary of Frequency vs. Antenna Gain

Two(2) Parallel 500 ft copper lines ,spaced 4ft apart, fed differentially at center point (250ft).Height above Average ground 30ft.

Frequency (MHz)	Gain over Isotropic (dBi)
7.0	5.41
10.1	7.0
14.0	11.91
18.1	18.06
21.0	10.08
24.9	10.2
28.0	11.2
50.0	7.61