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Via Courier and Email
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Federal Communications Commission
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RE: Interference Complaint, TXU and Amperion Corporation, Broadband Over Power Line System at Irving, Texas; Request for Immediate Cessation of Operation.

Gentlemen:

This office represents ARRL, the National Association for Amateur Radio, also known as the American Radio Relay League, Incorporated (ARRL). The purpose of this correspondence and the attached engineering exhibit is to complain of unlawful operation of a Broadband over Power Line (BPL) system located along Esters Road south of Route 183 in Irving, Texas (between Dallas and Fort Worth, Texas), on power lines owned and operated by TXU. On information and belief, the system utilizes equipment manufactured by Amperion Corporation. The result of tests conducted by ARRL laboratory manager Ed Hare, the author of the Test Reports attached hereto as *Exhibit A*, are that this facility, which has been the subject of an unresolved interference complaint dating back to November, 2004, is still regularly causing harmful interference to Amateur Radio stations and must be required to cease operation immediately.

The circumstances of this willful and repeated harmful interference are described in correspondence to the Commission from Jory McIntosh, a resident of Hastlet, Texas, and the licensee of Amateur Radio Station KJ5RM, who commutes through the affected area on a regular basis, and who has monitored the interference on a high-quality Amateur Radio receiver. His measurements of the interference were included in his complaint filed in November of 2004, to which the Commission has not responded to date. Nor has any action been taken, apparently, to reduce or eliminate the interference.

According to Mr. McIntosh:

My communications are not affected until I get within one mile of the BPL system location at which time my radio receiver is quickly overloaded with high levels of interference that blocks out all but the very strongest of signals on the amateur bands listed above. The interference is so bad that even with full filtering and digital signal processing engaged I am unable to continue my communications until I am one mile away from the system.

His measurements of the system last year were as follows:

<u>Date</u>	<u>Time</u>	<u>Frequency (MHz)</u>	<u>Mode Of Operation</u>	<u>Distance from System</u>	<u>S Meter Reading of Offending Signal</u>	<u>Notes</u>
7/24/2004	8:30	7.208	LSB	300 Ft	S9	Ham Conversations obliterated
7/24/2004	8:37	14.23	USB	300 Ft	S9+20	Ham Conversations obliterated
7/24/2004	8:40	18.151	USB	300 FT	S9+20	Ham Conversations obliterated
7/24/2004	8:42	21.364	USB	300 FT	S9+60	Ham Conversations obliterated
7/24/2004	8:44	28.34	USB	300 Ft	S9+20	Ham Conversations obliterated
7/24/2004	8:45	50.125	USB	300 FT	S9+20	Ham Conversations obliterated
8/5/2004	17:15	18.152	USB	1/4 Mile	S7	Communication Hampered
8/12/2004	17:35	18.14	USB	300 Ft	S9+20	Ham Conversations obliterated
8/19/2004	17:38	14.342	USB	300FT	S9	Communication Hampered
8/21/2004	12:09	18.148	USB	300 FT	S9	Communication Hampered
8/31/2004	18:01	18.138	USB	300 FT	S9+20	Ham Conversations obliterated
9/9/2004	16:45	18.151	USB	300 FT	S9+20	Ham Conversations obliterated
9/25/2004	12:42	21.35	USB	1/4 Mile	S5	Communication Hampered
10/7/2004	17:45	18.135	USB	300 Ft	S9+20	Ham Conversations obliterated
10/13/2004	16:34	14.245	USB	300 Ft	S9	Communication Hampered
10/23/2004	11:45	18.15	USB	300 Ft	S9+20	Ham Conversations obliterated
10/23/2004	11:46	21.25	USB	300 Ft	S9+20	Ham Conversations obliterated
10/23/2004	11:47	14.225	USB	300 Ft	S9	Ham Conversations obliterated
10/23/2004	11:48	7.25	USB	300 Ft	S7	Communication Hampered
10/27/2004	11:45	18.15	USB	300 Ft	S9+20	Ham Conversations obliterated
10/27/2004	11:46	21.25	USB	300 Ft	S9+20	Ham Conversations obliterated
10/27/2004	11:47	14.225	USB	300 Ft	S9	Ham Conversations obliterated

The TXU Irving, Texas system therefore currently causes harmful interference and it is not compliant with applicable FCC part 15 regulations, including Section 15.5 thereof.

Mr. McIntosh has complained to both TXU and Amperion, and on one occasion last July, representatives accompanied Mr. McIntosh on demonstrations of the interference. Whatever actions either entity might have taken (which, if any, were not revealed to Mr. McIntosh) to relieve the problem have *not* been successful, and it persists to the present time. Nothing has changed since the complaint was first lodged. **As of Wednesday, March 9, 2005, the system was producing the same amounts of interference within and outside the Amateur bands as reported above.**

ARRL therefore requests that the BPL facility at Irving, Texas be instructed to shut down immediately; and that it not resume operation unless the facility is shown to be in full compliance with Commission rules regarding radiated emissions and with the non-interference requirement of Section 15.5 of the Commission's Rules. As further support for these requests, ARRL states as follows:

Exhibit A reveals the substantial interference-causing noise across several of the most important and heavily-used HF allocations of the Amateur Service. The levels of interfering BPL signals are sufficient to obscure virtually all Amateur Radio received signals and preclude Amateur Radio communications in the areas and on the bands identified in the report.

The attached test results are sufficient to demonstrate that this BPL test site should be shut down immediately, pending compliance determinations, and a demonstration that the system can operate without causing harmful interference. ARRL does not believe that such can be demonstrated. ARRL requests that this station be shut down immediately and that appropriate monetary forfeitures be imposed against Amperion Corporation.

Kindly address all communications on this subject to the undersigned counsel.
Any Commission investigations of this matter should involve the complainant.

Yours very truly,

Christopher D. Imlay

cc: Steven Greene, Amperion
Director, Regulatory Affairs
Two Tech Drive, Andover, MA 01810
(via U.S. Mail)

EXHIBIT A

Testing of the Broadband Over Power Line System in Irving, TX

Testing Date: October 29, 2004

Time: 1600 – 2000 UTC

Test engineer: Ed Hare, ARRL Laboratory Manager¹

Report Revision: December 3, 2004

Discussion:

On October 29, 2004, ARRL Laboratory Manager Ed Hare met with Jory McIntosh in Irving, Texas. McIntosh is an operator licensed in the Amateur Radio Service who lives in Haslet, TX, a nearby community. He works regularly in the Irving area, and frequently operates mobile on the Amateur bands in that area and other parts of the area in Texas between 3.5 and 148 MHz. He serves as the ARRL Assistant Section Manager in North Texas. During the course of his mobile operation, he has observed considerable interference on the Amateur allocations, ranging to extremely strong on some bands in some areas of the BPL test. During these tests, Hare and McIntosh evaluated the interference levels from the trial BPL system operating in Irving.

Only one day was available to do this limited testing in Irving, TX, so the testing was not comprehensive. Some measurements were made of field strength on several frequencies and locations, but the more important information from this test was a frequency survey made with a whip antenna and receiver that showed that the “notching” programmed into the modems to mitigate interference is not adequate to protect most amateur spectrum. The notching also does not address interference to other services and users of HF.

The BPL system is being operated by TXU, the local electric utility. It uses BPL equipment manufactured by Amperion. This is an orthogonal, frequency-division multiplexed system that uses carriers spaced approximately 1.1 kHz across a wide range of HF and lower VHF. Each leg of the system uses different spectrum from adjacent legs, so each area has different amateur bands that are affected strongly. BPL noise that was weak on one leg was strong on another. Amperion uses BPL on the medium-voltage (MV) lines as the local backbone of the system and 802.11b wireless to get from the MV lines into homes and businesses.

Almost as soon as the system was installed several months ago, McIntosh observed extremely strong interference on Amateur spectrum. He initially filed verbal complaints with APS. In response, they made adjustments to the system. As the spectrum survey shown in Table 2 of this report shows, those adjustments did not address much of the interference reported by McIntosh, still leaving 10 to 20 dB of degradation of Amateur

¹ ARRL, 225 Main Street, Newington, CT 06111, Tel: 860-594-0318, Email: W1RFI@arrl.org, Web: <http://www.arrl.org/bpl>

spectrum throughout many portions of this test area, primarily in areas with overhead electrical wiring. On November 15, 2004, McIntosh filed a formal written complaint with the FCC, noting that the mitigation attempted to date had not been sufficient to protect stations operating in the Amateur Radio Service.

In addition to moderate to strong interference observed in the Amateur Radio Service bands, strong interference is seen on spectrum allocated to international shortwave broadcast; US government time and frequency signals (WWV); Citizens Band; low-VHF public-service and business spectrum and various aeronautical, commercial and government spectrum. Many of the bands that the new FCC regulations on BPL will require be notched are not protected at this time.

This system has not avoided the intentional use of amateur spectrum. At many points in the system, strong BPL interference was observed on several amateur bands, and at least several dB of degradation of the ability of the mobile receiver to receive amateur signals was present on one or more amateur bands in all portions of the system using overhead wiring.

Although the radiated emissions from the system were measured to be a few dB higher than the FCC limits, the excess was within the measurement uncertainty of the instrumentation and test method. For that reason, it cannot be clearly determined whether the system is in or out of compliance with the maximum emissions limits. ARRL recommends that this compliance be evaluated by an independent source with EMC-measurement experience and credentials.

As presently configured, the system is a small marketing trial. If this is deployed in its present form, it is certain that harmful interference to various spectrum users will occur and additional interference complaints are inevitable. Because it is causing harmful interference even in this small trial area to one or more radio Services, in that aspect, it is not operating in compliance with the Part 15 regulations that require that unlicensed emitters not cause any harmful interference. The fixed and mobile testing done at this time showed interference levels that will seriously degrade mobile and fixed-station operation near any part of the BPL system using the same spectrum as used by the system.

The susceptibility of the system to interference from nearby radio transmitters was not addressed at this time. ARRL recommends that TXU and Amperion undertake such testing, with volunteer amateur operators working cooperatively with Amperion and TXU staff to perform testing of the amount of interference that may be caused to the BPL system from the routine operation of fixed and mobile transmitters operating in the Amateur and Citizens Band Radio Services. These two Services will be in common use in areas where BPL is deployed.

BPL Test Area

The BPL test area is located starting at and to the east of the southern portion of Esters Road S in Irving. The portion of the test on Esters Road is served by overhead electrical wiring. The portion of the test to the east of Esters Road is primarily served by underground wiring. The Esters Road portion of the test is primarily urban residential and light industrial mixed zoning, with single-family homes, small businesses, a church and several apartment buildings. The area to the east is primarily single-family homes. The interference levels from the BPL system were strongest in the areas of overhead electrical wiring. Although some BPL noise was noted on some spectrum in the area of single-family homes served by underground wiring, in this area, such interference was at a lower level and localized to a few spot locations.

Test Equipment Used:

Manufacturer	Model	Description	Date Calibrated	Notes
Rohde & Schwarz	ESH2	EMC Receiver, 3-30 MHz	5 Feb 2004	Peak, quasi-peak or average power measurements Used for monitoring only
ICOM	PCR-1000	Computer-controlled general coverage receiver	ARRL calibrated against calibrated signal generators January, 2004	
ICOM	IC-R3	General coverage receiver	Not calibrated	
AH Systems	SAS-563B Various	Active loop antenna Loaded mobile whip antennas	11 Mar 2004 ARRL calibrated against SAS-563B on 1 Sep 2004	

Test-Fixture Configuration:

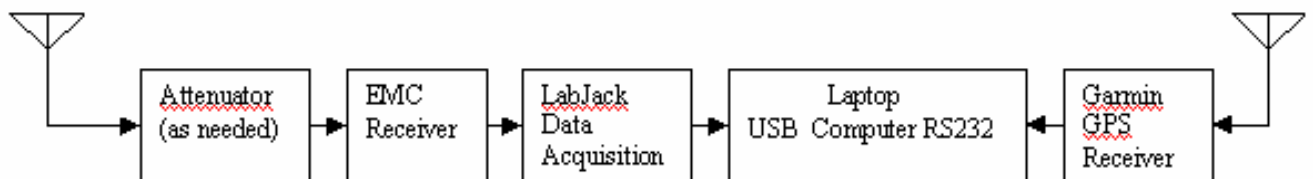


Figure 1: A laptop computer is used to read a data acquisition device connected to an EMC receiver meter-output voltage and GPS receiver to obtain calibrated field-strength measurement vs distance and position.

An ICOM PCR-1000 general-coverage receiver (0.1 – 1500 MHz) was used as the EMC receiver with a calibrated loop antenna to make measurements of field strength, using software written by the ARRL Laboratory staff. This system has been self-calibrated by the ARRL Lab against its calibrated Rohde and Schwarz ESH2 EMC receiver, and has shown good correlation with fully commercial and traceable equipment (+- 3 dB). The receiver was also used with a typical mobile whip antenna to make an assessment of the spectrum occupancy and relative field strengths of the BPL system.

This equipment was installed in a late-model sedan rental vehicle, using a magnetic-mount for the vertical whip. For testing with the calibrated loop, the vehicle was parked and the loop antenna was installed on a tripod located several meters away from the vehicle.

All equipment was powered from 12.6 volts through the vehicle’s accessory power jack. The laptop computer operates from its internal battery, which is periodically recharged with a DC-to-AC converter available in the vehicle. This converter is powered off during all testing. There are few "birdies" from the computer and these are easily avoided during testing.

Test Results

Field strength measurements were made at two locations. The following show the measured signal levels at these points:

Test point	GPS coordinates	Horizontal distance from power lines	Frequency	Measured Field Strength
Church parking lot	N32.82927° W97.01048°	36 meters	18.165 MHz	34.1 dBuV/m at 30 m Extrapolated at 20 dB/decade
Church parking lot	N32.82927° W97.01048°	36 meters	21.4 MHz	23.5 dBuV/m at 30 m Extrapolated at 20 dB/decade
Across the street from the church parking lot	N32.82925° W97.01002°	10 meters	18.165 MHz	30.6 dBuV/m at 30 m Extrapolated at 20 dB/decade
Across the street from the church parking lot	N32.82925° W97.01002°	10 meters	21.4 MHz	30.23 dBuV/m at 30 m Extrapolated at 20 dB/decade

Table 1: Measurements made at fixed locations in Irving, TX. These were made with the AH Systems loop antenna at a height of 5 meters. They do not include the 5-dB height

extrapolation required by the new FCC BPL regulations. The measurements made at 30 meters distance show that the system just exceeds the FCC limits at this distance and height above ground. If the 5-dB height extrapolation were added to the worst-case measurement, the field strength at that point would be 39.1 dBuV/m. (This would be 9.1 dB above the FCC limits.) A conservative 20-dB/distance decade distance extrapolation was used for these calculations. If the 40-dB/decade extrapolation were used at the distance measured, the field strength would extrapolate to 40.7 dBuV/m at 30 m. (This would be 10.7 dB above the FCC limits for 30 meters distance.)

Spectrum Occupancy Study

The PCR-1000 and a mobile whip antenna were used to evaluate the extent of the BPL system’s use of spectrum. When heard on a communications receiver, Amperion BPL equipment makes a distinctive noise, with modulated or unmodulated carriers present every 1.1 kHz throughout the spectrum the system uses. The test engineer has had considerable experience listening to Amperion equipment in several BPL test locations, so was able to easily differentiate by ear the BPL system from any ambient over-the-air signals that could be heard in spectrum that the BPL system was *not* using. Table 2 shows the spectrum used by the BPL system on the north end of the church parking lot. The vehicle was parked approximately 30 meters horizontally from the line.

Frequency	Signal level
18.000 MHz	Audible
18.068 – 18.168 MHz	S3 increasing to S9 (very strong)
19.010 MHz	Decrease to inaudible
21.000 MHz	Increase back to S9
21.990 MHz	Decrease back down to inaudible
22.700 MHz	Audible
25.000 MHz	Increase to S5
25.500 MHz	Decrease slowly back to inaudible at this frequency
27.140 – 30.92 MHz	S6 to S9+ through this spectrum
32.690 – 35.200 MHz	S6 to S9+ through this spectrum
37.12 – 40.9 MHz	S6 to S9+ through this spectrum

Table 2: This shows the spectrum being used by the BPL system as monitored near the road in the north part of the church parking lot. These data do not indicate spot frequencies where the BPL signal was heard, but rather show the points at which the signal started, peaked and then stopped. Through much of this frequency range, all but the strongest of the HF shortwave broadcast and commercial stations were covered up completely by BPL interference. In spite of the claims that this system had been notched, strong interference was observed on three Amateur bands; shortwave broadcast; commercial; government; military; Citizens Band; aeronautical and low-band VHF public-service and commercial spectrum. The antenna used was resonant on the 18.068

MHz Amateur band, so the signals picked up on other spectrum underestimates the field strength and interference potential at those frequencies.

Mobile Testing

In addition to the tests made at the above fixed locations, an assessment of the general area was made using a mobile receiver. The area of overhead wiring along Esters Road was evaluated, from its extreme southern point, where the BPL signal was just audible, northward to where it crosses over SR 183, where it became inaudible. Over the middle portion of this range, BPL signals were heard at a very strong level on Amateur and other spectrum for at least 1 km along the road. Interference along a road for that amount of distance is clearly harmful interference to mobile operation in that area and if the system is expanded, it will become impossible for mobile stations to continue practical operation in the BPL area.

Extensive listening was done in the area of single-family homes to the east of Esters Road. In this area of underground wiring, the BPL interference was considerably reduced and localized in nature. Although this mobile testing was not exhaustive, the indications are that in this area, mobile stations could operate by moving location a short distance if needed. The occasional areas where BPL interference was heard at a moderate level would cause harmful interference to nearby home stations, such as amateur, CB or those listening to international shortwave broadcasts on the upper portion of HF.